DELIMITATION OF THE GENUS *CERACIS* (COLEOPTERA: CIIDAE) WITH A REVISION OF NORTH AMERICAN SPECIES

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INTRODUCTION

The genus *Ceracis*, as it is here delimited, includes about 40 described species, occurring primarily in the New World. Mellié (1848) originally proposed the name for a subgenus of *Ennearthron*, the species of which were characterized by having 8, instead of 9, antennal segments. In the present paper, the limits of this genus are expanded to include species which may have 8, 9, or 10 antennal segments, but which share a number of prosternal and tibial characters to be discussed below. Although a complete revision is not possible at this time, some of the more apparent synonymies are included in the generic treatment, and detailed accounts are given for those species occurring in the United States and Canada.

Since the genera *Ennearthron* and *Ceracis* have been confused in the literature, it would be useful to outline briefly the history of both concepts. The genus *Ennearthron* was described by Mellié in 1847, but no species names were included. In 1848, Mellié placed 15 species in the genus, 5 of which comprised a new subgenus, *Ceracis*. The nominate subgenus was divided into 2 groups: species with the elytra "pubescentes" and those with the elytra "glabres." The first group included *E. cornutum* (Gyllenhal), *E. affine* (Gyllenhal), and *E. fronticornis* (Panzer). *E. cornutum*, which was later designated as type species by Desmarest (1860), has the prosternum somewhat tumid with a broad intercoxal process and the protibia with a single tooth at the apex; except for the antennal segmentation, it closely resembles many species of *Cis*. *E. affine* and *E. fronticornis* differ from *E. cornutum* in having the prosternum somewhat concave and the protibial apex bearing several small spines; these two species are now placed in the genus *Sulcacis* Dury (=*Entypus* Redtenbacher, not Dahlbom) (Lohse, 1964; Lawrence, 1965). The remaining 7 species form a more compact group in which the surface appears glabrous (actually covered with very short and fine hairs), the prosternum is concave, the intercoxal process laminate, and the protibial apex expanded and bearing several spines. These species differ from those placed in *Ceracis* only in the number of antennal segments.

Since Mellié's monograph was the first and only world revision of the family Ciidae, no further attempts were made to clarify these generic concepts. Lacordaire (1857) considered *Ceracis* to be generically distinct from *Ennearthron*, and subsequent authors added new species to both genera, usually on the basis of antennal segmentation alone. Most North American workers applied the name *Ennearthron* only to those species falling into Mellié's second group, and other forms with 9-segmented antennae were placed in different genera, such as *Dolichocis* Dury and *Plesiocis* Casey. The only exceptions are *Ennearthron transversatum*, *E. annulatum*, and *E. pallidum*, all described by Kraus (1908); these three

forms resemble the species of *Orthocis* Casey and may represent a distinct genus. European workers placed more weight on antennal characters and included a number of diverse forms within the genus *Enneartbron.*

At the present time, 54 nominal species of *Enneartbron* exist in the literature; in the following treatment, 26 of these (representing 16 valid species) are removed and placed in the genus *Ceracis.* The remaining species of *Enneartbron* still form a rather heterogeneous group. Some of them represent typical species of *Cis*, in which antennal segments have been miscounted, while the others represent at least 7 distinct phyletic lines, in which the number of antennal segments has become reduced. Several of these species probably should be placed in the genus *Cis*, in spite of the antennal segmentation, but further study will be necessary to determine their relationships. Of the 25 nominal species of *Ceracis*, 5 are removed and the remainder represent 15 valid species. These will be discussed in more detail below.

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METHODS AND TERMINOLOGY

Taxonomic characters. Color is of limited usefulness as a diagnostic character in this family because of the relatively long period of time between eclosion and the attainment of full pigmentation, during which tenerals are abundant in the population. It is even less useful in this genus because of its variation in fully pigmented adults. When color is used in descriptions, it is stated in simple terms, and words like "fuscous" and "piceous" are avoided. The texture of the pronotum and elytra, which is diagnostic for some species, may be described as distinctly granulate, lightly granulate, or smooth, and the surface sheen varies from dull to shiny accordingly. The vestiture is fairly constant throughout the genus, and differences in the lengths of the fine hairs are too small to be noted in the descriptions.

Head characters are used primarily for males (see below). The vertex is defined as the entire area between the eyes from the frontoclypeal ridge to the concealed occiput. In most Ciidae, the area in the vicinity of the frontoclypeal suture forms a ridge extending from the edge of one eye to the other. This is called the frontoclypeal ridge, since it contains parts of both the frons and the clypeus.

The antennae may be 8-, 9-, or 10-segmented, depending upon the number of segments between the scape and the 3-segmented club. Ratios between various segments may be of value at the specific level, but in this treatment only the ratio of segment III to segment IV has been used.

The pronotum varies considerably between species in size, shape, and punctation. The disc in some species is declined. The punctures are fairly evenly distributed, but there is some variation in the distances between them. Some measure of the coarseness and density of the pronotal punctation is obtained by comparing the average puncture diameter to the length of the scutellar base and the distances between punctures to the diameter of a puncture. Other pronotal characters are found only in males and will be discussed below.

The elytra also vary in size, shape, and punctation. The sides may be parallel for most of their lengths or rounded. The elytral punctation may be single—consisting of punctures uniform in size and distribution, or dual—composed of punctures of variable size and usually falling into 2 distinct size classes. When the punctation is dual, the larger punctures (or both sizes) are occasionally seriate, forming distinct rows. The coarsenesss and density of the larger elytral punctures may be compared

to that of the pronotal punctures. The diameter of an elytral puncture, though, is often difficult to measure, because of shadow effects caused by variation in the slope of the sides of the puncture. The shape of the elytra, as determined by a length–width ratio may be used as a diagnostic character, since it does not differ between the sexes.

Prosternal characters are used only in the generic description. The term "body of prosternum" refers to that part in front of the coxal cavities, and this is continued posteriorly as the laminate intercoxal process. The postcoxal process is a mesial continuation of the pronotal hypomeron.

There is some variation in the numbers of spines on the apex of the protibia, but this variation is intraspecific as well as interspecific. The exact number of spines is difficult to determine since the spines grade into fine setae toward the inner angle. For these reasons, protibial characters were not used in the species descriptions or diagnoses.

The metasternum varies somewhat in its shape, and the metasternal suture varies in length as compared to the median length of the sternal plate. The abdomen also varies somewhat in length, but has not been used. The setigerous pore in the middle of sternite III is found in males only. Characters involving the 8th sternite of the male and the aedeagus have not been used in species descriptions, because there seems to be little variation here between species. This is in marked contrast to genital characters in the genus *Cis*, which are often diagnostic for species or species groups. In the generic description, the terms tegmen and median lobe are used, following Sharp and Muir (1912).

Secondary sexual characters. In all species of the genus, the males are characterized by having a setigerous pore on the first visible abdominal sternite (sternite III). This pore, which may be circular or transversely oval, smaller or larger in size, distinctly or indistinctly margined, and located at the middle of the sternite or posterad of this, is a useful diagnostic character for males, since it does not appear to vary within a species. In indicating the size and position of the pore, the term "body of sternite" refers to that portion behind the intercoxal process.

The males of most species differ from females also in the shape of the pronotum, the development of the pronotal apex, and the structure of the frontoclypeal ridge. The use of these characters to separate species, however, requires a good deal of caution and has led to the formation of a number of synonyms in the past. Each of these characters varies within a species, and the variation may be considerable. The shape of the pronotum is the least variable, if one excludes the development of the apex. Larger male specimens often have the pronotum expanded laterally and the sides subparallel, whereas smaller males and all females have the sides more rounded and not expanded. The apex of the pronotum may be rounded or weakly emarginate in the males of some species, produced forming two tubercles, teeth, or horns in others, and forming an emarginate lamina in others. The teeth or horns vary in size and may be parallel or diverging. In all of these species, the smaller males have weakly developed pronotal characters, and the smallest specimens can barely be distinguished from females on the basis of this character alone. The frontoclypeal ridge is simple and rounded or truncate in some species, and variously produced in others, forming an emarginate lamina, two tubercles or horns, or an elongate median horn. These characters also vary within a species, and in smaller males they are barely developed.

The matter is further complicated by the fact that the pronotal and frontoclypeal characters vary allometrically, so that the length of a pronotal lamina increases logarithmically with an arithmetic increase in another character such as elytral length. The curious situation then arises that the form which "characterizes" a given species,

or that which most easily distinguishes it from related species, is present only in the largest males, which comprise a minority of the population.

Measurements and ratios. The pronotal length (PL) is measured along the midline, and in males it includes the horns or laminae. The pronotal width (PW) is the greatest width. The elytral length (EL) is taken just to one side of the midline from the base of the scutellum to the elytral apices. The elytral width (EW) is the greatest width. The total length is the sum of PL and EL and does not include the head; it is given in mm. For one sample of each species, the range, mean, and standard error of the mean are given for the total length and for the following ratios: TL EW, PL PW, EL EW, EL PL. In the description, these ratios are given for a male and a female (holotype and allotype or plesiotypes), and the statistical treatment is included in the section on variation. Ratios are used in the keys only when there is very little or no overlap between species or groups of species.

Locality data. Because of the large numbers of specimens examined, complete data are given only for types or plesiotypes. For each species, the total number of specimens examined is included, followed by a list of localities, and the institutions or private collections providing the material for study. The localities are grouped according to general area (Canada, United States, Mexico, Central America, West Indies), subgrouped alphabetically by province, state, or country, and listed alphabetically within each. The following abbreviations are used to indicate the sources of material: AMNH, American Museum of Natural History; ANSP, Academy of Natural Sciences of Philadelphia; BBM, Bernice P. Bishop Museum; BMNH, British Museum (Natural History); BRUS, Institut Royale des Sciences Naturelles de Belgique; BYU, Brigham Young University; CAS, California Academy of Sciences; CDA, California State Department of Agriculture; CIN, Cincinnati Museum of Natural History; CM, Carnegie Museum; CNC, Canadian National Collection; CNHM, Chicago Natural History Museum (Field Museum); CU, Cornell University; GEN, Muséum d'Histoire Naturelle, Geneva; HH, Henry Howden Collection; INHS, Illinois Natural History Survey; JFC, J. F. Cornell Collection; JFL, J. F. Lawrence Collection; JS, Joe Schuh Collection; KU, University of Kansas; MCZ, Museum of Comparative Zoology; MNHN, Muséum National d'Histoire Naturelle, Paris; PURD, Purdue University; UAL, University of Alberta; UAZ, University of Arizona; UCD, University of California, Davis; CIS, California Insect Survey; USNM, United States National Museum; UW, University of Washington.

Host data. The host fungi are listed according to the apparent order of preference. For each fungus species, the total number of records is given, and this is followed by the number of apparent breeding records (in parentheses). For the purposes of this study, a breeding record is any collection with 10 or more adults or 1 or more tenerals or immatures. Only those collections in which the fungus was determined by a known specialist (my own records and those of R. C. Graves and H. S. Dybas) are included as breeding records. The nomenclature follows that of Overholts (1953), Lowe (1957, 1966), and Lowe and Gilbertson (1961a, 1961b), but the generic placements are those of the latter two authors. Records were obtained by collecting specimens in the field or rearing them in the laboratory. Identifications were made by several specialists mentioned above in the acknowledgments. Further information on the host fungi is contained in the section on North American *Ceracis*.

GENERIC TREATMENT

Subfamily CIINAE Leach
Genus *CERACIS* Mellié

Ennearthron (*Ceracis*) Mellié, 1848: 375. Type species, by present designation, *Ennearthron* (*Ceracis*) *sallei* Mellié, 1848: 377.

Ceracis Mellié; Lacordaire, 1857: 553; Jacquelin DuVal, 1857: 246; Reitter, 1878: 37; Gorham, 1883: 223 (in part); Gorham, 1886: 359; Horn, 1894: 391; Gorham, 1898: 332 (in part); Casey, 1898: 90; Blatchley, 1910: 900; Dalla Torre, 1911: 25; Pic, 1916a: 20; Dury, 1917: 27; Lesne, 1917: 192; Leng, 1920: 247; Pic, 1922: 2–3; Zimmerman, 1942: 51; Blackwelder, 1945: 549; Arnett, 1962: 829.

Cerasis Demarest, 1860: 261. Incorrect subsequent spelling.

Ceratocis Gemminger and Harold, 1869: 1800. Unjustified emendation.

Bostrichus, — Bosc, 1791: 6; Bosc, 1792: 259.

Cis, — Ziegler, 1845: 270; Mellié, 1848: 236 (in part); Blair, 1935: 295 (in part).

Ennearthron, — Mellié, 1847: 110 (in part); Mellié, 1848: 360 (in part); Jacquelin DuVal, 1857: 245 (in part); Lacordaire, 1857: 552 (in part); LeConte, 1867: 58; Gemminger and Harold, 1869: 1799 (in part); Abeille de Perrin, 1874: 80 (in part); Reitter, 1878: 36; Casey, 1884: 36; Casey, 1898: 87; Reitter, 1902: 59 (in part); Fauvel, 1904: 163; Blatchley, 1910: 900; Dalla Torre, 1911: 23 (in part); Pic, 1916a: 19 (in part); Dury, 1917: 22 (in part); Leng, 1920: 247 (in part); Brethes, 1922: 303; Scott, 1926: 35 (in part); Pic, 1939: 18; Blackwelder, 1945: 549 (in part); Miyatake, 1954: 55 (in part); Arnett, 1962: 829 (in part); Hatch, 1962: 234.

Octotemnus, — Tanner, 1934: 47.

Scolytocis, — Blair, 1944: 126.

Xestocis (in part), — Dury, 1917: 15; Leng, 1920: 247; Arnett, 1962: 829.

Xylographus, — Gorham, 1886: 355 (in part).

Diagnosis. This genus may be distinguished from other members of the Cinae by the oval to elongate and cylindrical body form, the narrow lateral pronotal margin and obtuse or rounded anterior pronotal angles (Fig. 1), the concave prosternum and laminate prosternal intercoxal process (Figs. 2–3), the apically expanded protibia, which bears several spines along the outer apical angle (Fig. 4), the strongly convex metasternum with the suture short or absent (Fig. 5), the vestiture consisting of very short and fine hairs, and the form of the aedeagus (Figs. 9–10).

Description. Size relatively small, TL ranging from about 0.80 to 2.20 mm. Form oblong and suboval to elongate and cylindrical, strongly convex. Vestiture consisting of very short and fine, suberect or decumbent hairs. Head strongly declined, partly to almost completely concealed from above by pronotum; vertex flat or impressed, often with a median tubercle or boss and occasionally with an erect horn; frontoclypeal ridge in male usually produced and elevated, forming a lamina which may be truncate or emarginate, the apex of the lamina often with 2 lateral pilose patches, occasionally forming 1 or 2 distinct tubercles or horns; genal ridge weakly elevated and subcarinate, forming a shallow antennal fossa between it and the eye. Antennae 8- to 10-segmented, with a large, loose, 3-segmented club, each club segment bearing 4 sensory pores; maxilla with mediostipes subtriangular, lacinia subterminal, subequal to galea, which is terminal, short and broad, terminal segment of maxillary palp usually narrow and elongate; prementum somewhat elongate, terminal segment of labial palp shorter and narrower than penultimate segment. Pronotum transverse to elongate, narrowly margined laterally and posteriorly, the lateral margins not visible for their entire lengths from above, anterior angles obtuse, rounded or subangulate, not produced forward (Fig. 1); anterior edge in male rounded, or produced, forming a lamina or 1 or 2 teeth or horns, the apex of each horn or the apicolateral angles of lamina often with a pilose patch above. Scutellum usually broadly triangular. Elytra longer than broad, the sides rounded or subparallel; punctation single or dual, the punctures uniform, confused, or seriate. Prosternum concave or very slightly tumid mesially, always concave or biconcave in cross-section, body shorter than intercoxal process, which is laminate, less than 0.12 × as wide as a procoxal cavity; posteoxal processes acute, extending mesad for about 0.80 of coxal width, leaving narrowly open behind the procoxal cavities, which are about 0.50 × as long as wide (Figs. 2–3). Protibia strongly expanded at apex, the outer apical angle forming a rounded process, which bears several spines, grading into setae

toward the inner angle (Fig. 4). Metasternum strongly convex; suture less than 0.50 × as long as median length of sternum, usually very short or absent (Fig. 5). Meso- and metatibiae slightly expanded and spinulose at apices. Abdomen somewhat shorter than wide at base, strongly convex; sternite III in male with median, setigerous pore, which may be circular (Fig. 6) or transversely oval (Fig. 7); sternite VIII in male short and broad, base bisinuate, apex emarginate, the apical angles rounded, each with a group of setae (Fig. 8). Tegmen moderately elongate, rounded basally, broadly and deeply emarginate apically, lightly pigmented basally and laterally (Fig. 9); median lobe subequal in length to tegmen, narrow, as in Figure 10.

Originally included species: Ennearthron (*Ceracis*) *sallei* Mellié (selected as type species above), *E.* (*C.*) *castaneipennis* Mellié, *E.* (*C.*) *militaris* Mellié, *E.* (*C.*) *furcifer* Mellié, *E.* (*C.*) *variabilis* Mellié.

Presently included species. As it is here delimited, the genus *Ceracis* includes a number of species formerly placed in *Ennearthron*, and several which have been removed from other genera. In the list below, the original generic placement and literature citation are given for each, as well as the type locality and location of type material where possible. Brief synonymies are given for all those species not treated later in the section on the North American fauna.

Ennearthron bicornis Mellié, 1848: 374. "Perou." Melly Coll., GEN.

Ennearthron californicum Casey, 1884: 36.

Ennearthron (*Ceracis*) *castaneipennis* Mellié, 1848: 376. "Cuba." Marseul Coll., MNHN.

Cis nitidulus Mellié, 1848: 334. "Lombardie." Marseul Coll., MNHN.

Ceracis ater Pic, 1922: 2. "Guadeloupe." Pic Coll., MNHN. NEW SYNONYMY.

Ceracis rufipes Pic, 1922: 2. "Guadeloupe." Pic Coll., MNHN. NEW SYNONYMY.

Ennearthron corniferum Mellié, 1848: 371. "Bresil." Marseul Coll., MNHN.

Ennearthron cucullatum Mellié, 1848: 372. "Cayenne." Pic Coll., (Chevrolat Coll.), MNHN.

Ennearthron tabelliferum Mellié, 1848: 373. "Cap de Bonne Esperance." Marseul Coll., MNHN. NEW SYNONYMY.

Ennearthron bilamellatum Pic, 1916a: 20. "Madagascar." Pic Coll., MNHN. NEW SYNONYMY.

Ennearthron lamellatum Pic, 1939: 8. "Bresil." Pic Coll., MNHN. NEW SYNONYMY.

Ennearthron curtum Mellié, 1848: 367.

Ennearthron cylindricum Brethes, 1922: 303. "General Urquiza." [Argentina]. Location of type unknown.

Octotemnus dixiensis Tanner, 1934: 47.

Scoltyocis evansi Blair, 1944: 126. "Fiji: Taveuni." BMNH.

Bostrichus furcatus Bosc, 1791: 6. "Jamaica." Location of type unknown.

Ennearthron (*Ceracis*) *furcifer* Mellié, 1848: 379. "Cayenne." Melly Coll., GEN.

Ceracis semipallidus Pic, 1922: 3. "Guadeloupe." Pic Coll., MNHN. NEW SYNONYMY.

Cis furcicollis Blair, 1935: 295. "Hiva Oa: Kopaafaa." [Marquesas]. BBM.

Ennearthron hastiferum Mellié, 1848: 370. "Colombie." Melly Coll., GEN.

Ennearthron japonum Reitter, 1878: 36. "Japan." Pic Coll. (Reitter Coll.), MNHN.

Xylographus latirostris Gorham, 1886: 355. "Guatemala. . . .Zapote." BMNH.

Ennearthron (*Ceracis*) *militaris* Mellié, 1848: 378. "Mexique." Marsuel Coll., MNHN.

Cis minutissimus Mellié, 1848: 334.

Ceracis minuta Dury, 1917: 25.

Ceracis monocerus, NEW NAME (See below).

Ennearthron multipunctatum Mellié, 1848: 368.

Ennearthron nigricans Fauvel, 1904: 163. "Noumea." [New Caledonia]. Fauvel Coll., BRUS.

Ceracis nigropunctatus, NEW SPECIES (See below).

Ceracis obrieni, NEW SPECIES (See below).

Ceracis palaceps Zimmerman, 1942: 51. "Guam." USNM.

Ceracis powelli, NEW SPECIES (See below).

Ennearthron pullulum Casey, 1898: 90.

Ceracis punctulata Casey, 1898: 90.

Ceracis punctulatus rubriculus, NEW SUBSPECIES (See below).

Ceracis quadricornis Gorham, 1886: 359.

Ceracis quadridentatus Pic, 1922: 3. "Guadeloupe." Pic Coll., MNHN.

Ceracis ruficornis Pic, 1916a: 20. "Bresil." Pic Coll., MNHN.

Ennearthron (*Ceracis*) *sallei* Mellié, 1848: 377.

Ceracis schaefferi Dury, 1917: 25.

Ennearthron shikokuense Miyatake, 1954: 56. "Omogokei, Iyo." [Shikoku, Japan]. Matsuyama Agric. College, Japan.

Ennearthron simplicicorne Pic, 1916a: 19. "Buenos-Ayres." Pic Coll., MNHN.

Ceracis similis Horn, 1894: 391. "Coral de Piedra, Sierra el Taste." [Baja California]. CAS.
Xestocis singularis Dury, 1917: 15.
Enneartlıron taurulus Jacquelin DuVal, 1857: 245. "Cuba." Guerin-Meneville Coll., BRUS.
Ceracis bison Reitter, 1878: 37. "Cuba." Oberthur Coll., MNHN. NEW SYNONYMY.
Cis thoracicornis Ziegler, 1845: 270.
Ceracis unicornis Gorham, 1898: 332. "St. Vincent." [West Indies]. BMNH.
Enneartlıron (*Ceracis*) *variabilis* Mellié, 1848: 380. "Cuba." Pic Coll. (Chevrolat Coll.), MNHN.

Five other species described in this genus have been or are here removed. *Ceracis compressicornis* Fairmaire was placed in the genus *Cis* by Lesne (1917); it belongs to a group of Indo-Pacific species, which are short and broad, and have a carinate prosternum, expanded (but not spinose) protibial apex, and 2 long, frontoclypeal horns in the male. *Ceracis tricornis* Gorham (1883: 224) and *Ceracis sumatrensis* Pic (1916b: 6) both should be placed in the genus *Cis*. The two species have a carinate prosternum, 10-segmented antennae, and a dentate protibial apex, and they would be placed within the genus *Eridaulus*, as delimited by me in a recent publication (Lawrence, 1965: 282). A further study of this group, however, has raised some doubt in my mind as to the distinctness and homogeneity of *Eridaulus*. *Ceracis tricornis* belongs to the *Xestocis miles* complex, while *C. sumatrensis* is related to *Cis pacificus* and its allies; these two species groups are distinct from the *Cis nitidus* group (*Eridaulus*) and all three probably should be included within the genus *Cis*. *Ceracis bifureus* Gorham (1898: 332) and *Ceracis laticornis* Pic (1922: 3) have 10-segmented antennae, carinate prosternum, and a protibia which is serrate along the outer edge, while *Ceracis particularis* Pic (1922: 3) has 8-segmented antennae, a broad prosternal intercoxal process, and rounded protibial apex; these three species cannot be placed in any existing genus.

Etymology. Keras, Gr., horn + kis, kios, Gr., woodboring worm or weevil; masculine.

Distribution. Widespread and common in the New World, from southern Canada to Argentina, with 34 described species. Also known from South Africa, Madagascar and vicinity (1 species), Japan (2 species), Micronesia (1 species), Polynesia (2 species), and New Caledonia (1 species). Only one introduced species (*C. cucullatus*) known in the European fauna. A large number of Neotropical species and several Indo-Pacific species remain to be described.

Host range. Since little or nothing is known about the biology of many species, it is difficult to generalize about host range at the generic level. A few general remarks can be made at this point and a more detailed discussion of host preferences will be included in the section on North American species. All of the species of *Ceracis* for which biological data have been recorded occur on the woody fungi (especially Polyporaceae), in contrast to the members of the genus *Orthocis* and a number of *Cis*, which are associated with softer fruiting bodies or mycelial growth. Since the genus is primarily a tropical one, many species have been collected in the fruiting bodies of *Ganoderma*, a large genus of polypores with many tropical forms. A number of New World species occur on a group of fungi which have reddish or brownish sporophores (*Polyporus gilvus* group), and in North America these are practically the only species which utilize these fungi. Members of the *Ceracis furcifer* group (discussed below) appear to be restricted to *Polyporus versicolor* and its relatives. Some of the species of *Ceracis* occur on a large number of different fungi, but several others appear to be rather host specific.

Discussion. Although the members of the genus *Ceracis* can be easily distinguished from species of *Cis* and most other Ciinae by the concave prosternum, laminate prosternal process, and spinose protibial apex, there are several other described genera which have one or more of these characters. The genera *Strigocis* Dury and *Sulcacis* Dury have a similar protibial struc-

ture; in *Sulcacis* the prosternum is somewhat concave or biconcave, but the intercoxal process is broader, while in *Strigocis* the prosternum is strongly tumid and carinate, the anterior pronotal angles are more pronounced, and the elytral suture is margined posteriorly. In both genera, the vestiture consists of longer hairs or stout bristles, and aedeagus is of a different type. *Falsocis* Pic and *Neoennearthron* Miyatake have a similar prosternum with the intercoxal process laminate, but both have a different protibial structure. The two closely related and probably synonymous genera *Wagaicis* Lohse and *Odontocis* Nakane and Nobuchi resemble *Ceracis* with respect to the prosternal structure, protibial structure, and type of vestiture, but in both genera the anterior angles are somewhat produced and the aedeagus is of a different type. In *Paraxestocis* Miyatake, the intercoxal process is laminate and the protibia is spinose, but the prosternum is carinate and the protibial spines extend proximad along the outer edge. *Malacocis* Gorham is also characterized by having a concave prosternum, laminate intercoxal process and spinose protibial apex, but the members of this genus are very short and broad, with a very short prosternum, and the vestiture consists of short, stout bristles.

Notes on species and species groups. Although the main body of this paper is devoted to the North American representatives of *Ceracis*, the following section has been included to clarify some of the relationships among the species not occurring north of Mexico or found only in the Old World. Some of the more apparent species synonymies have been included in the species list above, but a few other names will probably be placed in synonymy when a more thorough study of the genus is undertaken.

Ceracis furcifer group. This group consists of 9 described New World species, one of which (*C. semipallidus* Pic) has been synonymized with *C. furcifer*. All of the species have a similar body form, fine and sparse pronotal and elytral punctation, a rounded or shallowly emarginate pronotal apex and a median frontoclypeal horn in the male. Six of these species—*C. cornifer*, *C. cylindricus*, *C. hastifer*, *C. monocerus*, *C. simplicicornis*, and *C. unicornis*—have 9-segmented antennae, and a frontoclypeal horn which is rounded, truncate, or shallowly emarginate at the apex. The other two species—*C. furcifer* and *C. ruficornis*—have 8-segmented antennae and a frontoclypeal horn which is deeply incised at apex so that 2 branches are formed. The species within each subgroup differ only in characters of color, punctation, and horn shape, and most of them are allopatric on the basis of known material. These described forms may well be races of 2 polytypic species, but they have not been considered as such, either because the type has not been examined (*C. cylindricus*) or because sufficient series are not yet available.

Ceracis cucullatus group. This group consists of at least 5 species—*C. cucullatus*, *C. bicornis*, *C. tabellifer*, *C. bilamellatus*, and *C. lamellatus*—the last 3 of which have been synonymized with *C. cucullatus* above. The North American *C. thoracicornis* may also be included in this group. The species are moderately long and narrow, with 9-segmented antennae, fine and sparse pronotal and elytral punctation, and a relatively long lamina on the pronotal apex of the male, this lamina being deeply emarginate in *C. bicornis* (and in *C. thoracicornis*) so that 2 narrow horns are formed, but very shallowly emarginate in *C. cucullatus*. The other 3 forms were described as new on the basis of size and development of pronotal characters in the male, both of which vary within any one population. *C. cucullatus* is the most widespread species in the family. It is common throughout the Neotropical region from central Mexico to southern Brazil; Scott (1926) has reported it from Grenada, and I have seen a large number of specimens from the Galapagos Islands. In the Old World, it has been recorded from France (noted as an intro-

duction), South Africa, N. W. Rhodesia, Madagascar, Reunion, Mauritius, the Seychelles, and Aldabra (Abeille de Perrin, 1874; Lesne, 1917; Mellié, 1848; and Scott, 1926). The Old World specimens do not appear to be specifically distinct from the Neotropical form, and the present range in southern Africa and the Malagasy region is probably the result of a recent expansion following an early introduction from South America. *C. bicornis* is also widespread in the New World tropics, and specimens have been seen from Mexico, Guatemala, Cocos Islands, Costa Rica, Peru, and southern Brazil.

Ceracis furcatus, *C. variabilis*, *C. militaris*, and *C. minutus*. These 4 names apply to very small species, which may or may not be related, but which are easily confused and have been erroneously cited in the literature. *C. furcatus* (Bosc) is known only from a short description and a figure (Bosc, 1792: 259, pl. 38, A–C); Lesne (1917) placed it in the genus *Ceracis* on the basis of the illustration. The diverging pronotal horns are very similar to those in Mellié's figure of *C. militaris*, but the type specimen of *C. militaris* does not look like the same species. Gorham (1883) synonymized *C. furcifer* (discussed above) with *C. militaris*, on the basis of misidentified specimens in the Sallé collection, and recorded the species from several localities in Mexico and Guatemala. In 1886, he noted his error and referred all but one series of specimens to *C. furcifer*. The remaining series from Veracruz was identified as *C. militaris*, but I have not seen the specimens to verify this. In 1898, Gorham referred a series from St. Vincent to *militaris* as well. *C. variabilis* was described by Mellié on the basis of Cuban specimens with 2 very weak tubercles on the pronotal apex of the male. After examining the collections in Paris, I could find only a single female which may have come from the type series of Mellié; in general form and punctation, this specimen appears to be conspecific with a series from Antigua, Puerto Rico, Cuba, Montserrat, and the Virgin Islands, the larger males of which have horns resembling Bosc's illustration of *C. furcatus*. I think that *C. variabilis* is probably synonymous with the Jamaican *C. furcatus* and with Gorham's "*militaris*" from St. Vincent, and that *C. militaris* from Mexico is a distinct species. *C. minutus*, from North America and the West Indies, is probably related to this group, but it appears to be a distinct species. Further collecting in Mexico will be necessary to clarify the status of *C. militaris*.

"*Xylographus*" *latirostris*. This species was described from a pair of specimens from Zapote, Guatemala. The male holotype has 10-segmented antennae and a rather stocky appearance like that of *Xylographus*, but several characters exclude it from that genus. The procoxae, intercoxal process, and protibial apex are of the *Ceracis* type, and I think the species should be placed provisionally in this genus. The "female" paratype is actually a male of an entirely different species, and it belongs in a genus which is not yet described.

Miscellaneous Neotropical species. *Ceracis castaneipennis* is widespread in the West Indies but does not extend into the United States. It is probably related to *C. curtus* and is further mentioned in the discussion of the latter species. *Ceracis quadridentatus* is known from only 2 specimens collected on Guadeloupe. It is apparently a distinct species, but sufficient notes were not taken on the type to relate it to other Neotropical *Ceracis*. *Enmearthron taurulus* from Cuba is a short and broad species with 2 long frontoclypeal horns in the male; it does not appear to be closely related to any other *Ceracis*.

Indo-Pacific *Ceracis*. *Enmearthron japonum* and *E. shikokuense* are two closely related species from Japan; both are elongate and have 9-segmented antennae. The two species may form part of the *Ceracis cucullatus* group. *C. furcicollis* was placed by Blair in the genus *Cis* because of the 10-

segmented antennae; it definitely belongs in *Ceracis* and closely resembles *C. singularis* in the form of the pronotal horns. *Scolytocis evansi* is a peculiar species with a single horn on the pronotum and another erect horn on the vertex in the male; Blair described this species at a time when the type of *Scolytocis samoensis* was not available for comparison. *S. samoensis* is the only described species in that genus, which is related to *Xylographus*. *Ceracis palaceps* from Micronesia and *Ennearthron nigricans* from New Caledonia are both distinct species of *Ceracis* which are probably not closely related to any other known form.

THE NORTH AMERICAN SPECIES OF *CERACIS*

Ceracis is the second largest genus of Ciidae occurring in the New World, consisting of 35 described forms distributed from southern Canada to Argentina. In North America, there are 18 species, 4 of which are here described as new. In the present treatment, species which occur in Mexico but do not extend into the United States are excluded. The present revision must be considered as a preliminary one, since there are several undescribed species in the southeastern United States, for which adequate series are not yet available.

Origin and distribution. The North American species of *Ceracis* appear to be entirely Neotropical in origin. With the exception of two species in southern Japan, there are no *Ceracis* in the Palaearctic region and the several Indo-Pacific species do not appear to be closely related to any of the New World forms. The group may have originally developed in the Old World, however, since several related genera (*Wagaicis*, *Odontocis*, *Neoennearthron*, and *Paraxestocis*) occur there. The genus is a dominant group in the New World and includes some of the commonest species in the North American fauna.

The species of *Ceracis* occurring in the United States and Canada may be placed in 4 groups on the basis of distributional patterns:

1) Northern Group. These species are fairly widely distributed throughout the eastern part of the continent and usually extend into the northern United States and southern Canada. With 2 exceptions (a single record each of *C. singularis* from Costa Rica and *C. punctulatus* from western Cuba) none of the species extend south of the United States. Included species: *C. minutissimus*, *C. punctulatus*, *C. sallei*, *C. singularis*, *C. thoracicornis*.

2) Western Mexican Group. These species occur in western Mexico and the southwestern United States, with one of them, *C. californicus*, extending north along the Pacific Coast. Included species: *C. californicus*, *C. dixiensis*, *C. obrieni*, *C. powelli*.

3) Eastern Mexican Group. The three species in this group occur along the Gulf Coast and extend into eastern Mexico and Central America. Included species: *C. nigropunctatus*, *C. quadricornis*, *C. schaefferi*.

4) West Indian Group. Members of this group occur in the Gulf Coast area and the Southern Coastal Plain, but are most common in Florida and the Greater Antilles. Included species: *C. curtus*, *C. minutus*, *C. monocerus*, *C. multipunctatus*, *C. pullulus*.

It is probable that the species in the first group include most of the older elements in the North American fauna, while those in the last three groups, with the possible exception of *C. californicus*, represent more recent southern derivatives.

Linsley (1958), in his analysis of North American cerambycid beetles, recognized five major faunas and one subfauna. The Holarctic and Vancouveran faunas include younger and older northern elements with Palaearctic affinities and cannot be applied to the species of *Ceracis*. The Alleghenian fauna consists of both northern and southern elements, which have entered the fauna early enough to exist as endemics in North America. The 5 species in group 1), above, probably correspond to the southern ele-

ments of Linsley's Alleghenian, and, like the cerambycids in this fauna, they are associated with the eastern lowland hardwood forests. The Neotropical fauna consists of relatively recent southern elements which occur in eastern North America and also in the West Indies or Mexico; the species in groups 3) and 4), above, represent elements of this fauna. Group 2) corresponds with Linsley's Sonoran fauna in the broad sense, since the species occur both in the Southwest and in northern Mexico. *Ceracis dixiensis* and probably *C. obrieni* are typical members of the Sonoran fauna and inhabit the Lower Sonoran Life Zone, but *C. californicus* and *C. powelli* usually occur in the Upper Sonoran and Transition zones. The distribution of *C. californicus* is more suggestive of the Californian subfauna, which consists of older southern elements.

Host preference. Although it may seem inappropriate to include a discussion of fungi and ecological preferences in a purely taxonomic paper, a brief treatment is included here to emphasize the role of host selection in the evolution of the Ciidae and to clarify the statements on host specificity in the species discussions to follow. A more general work on host preference in the North American Ciidae will soon be ready for publication, so that future taxonomic papers will not be similarly burdened.

The majority of species of Ciidae live the greater part of their lives within the dead fruiting bodies of various wood-rotting fungi (Basidiomycetes: Polyporaceae, Hydnaceae, Thelephoraceae, and Agaricaceae), where both larvae and adults feed on sterile hyphal tissue. This type of habitat differs from that formed by the ground-inhabiting fungi (Boletaceae and most Agaricaceae) in that the substrate is tougher and more durable, allowing the insects to complete their development within a single fruiting body and at the same time necessitating the development of boring adaptations similar to those evolved in various groups of xylophagous insects.

It has long been suspected that mycetophagous beetles exhibit a preference for one or more fungus species, and early workers, such as Weiss and West (1920, 1921), and Donisthorpe (1935), published lists of known host associations and emphasized the value of correct fungus identifications. In recent years, several papers have been published on the food habits of fungus beetles (Benick, 1952; Graves, 1960; Rehfous, 1955; Scheerpeltz and Höfler, 1948), but the first worker to clearly demonstrate the existence of host preference patterns in the Ciidae was Paviour-Smith (1960), in a study based on 10 ciid species occurring in southern England. Intensive field studies in Wytham Woods, near Oxford, England, and a critical compilation of previous host records for that general area revealed that the fungi could be placed into two distinct groups, each with a characteristic fauna of ciid beetles. The first group includes *Polyporus versicolor*, *P. hirsutus*, *Lenzites betulina*, and *Trametes gibbosa*, all of which have a complex (trimitic) hyphal system, while the second group includes a somewhat more diverse assemblage (*Polyporus betulinus*, *P. adustus*, *Ganoderma applanatum*, *Pleurotus sapidus*, and others) which are characterized by having a simpler (monomitic or dimitic) hyphal system. The beetles rarely occurred on fungi in the "wrong" group, and within each group particular beetle species often preferred a single fungus, which was termed its "headquarters." My own unpublished data on the North American Ciidae tend to support the existence of these two host preference groups based on hyphal structure, as well as two more groups including fungi which were not treated in Paviour-Smith's study. These will be mentioned below as they pertain to the species of *Ceracis*.

Before continuing with the subject of host preference, it is necessary to make a few remarks on the classification of the wood-rotting fungi. At the present time, the generic limits in the Polyporaceae and related families are controversial, and so many generic names have been proposed that some

authorities, including Lowe and Gilbertson, have utilized the older Friesian genera, which are admittedly based on superficial morphological characters of the sporophore and do not necessarily reflect current ideas on the evolution of the group. A clearer picture of the phylogenetic relationships among these fungi is gradually emerging as a result of studies on the microstructure of the fruiting body (Cunningham, 1947) and the characters of living cultures (Nobles, 1958, 1965; Lowe and Gilbertson, personal communication).

The following are the species of fungi from which various *Ceracis* have been recorded:

Boletaceae: *Boletus* sp. (the only ground-inhabiting fungus; a single record of *C. thoracicornis* is almost certainly accidental).

Agaricaceae: *Pleurotus ostreatus* Jacq.

Hydnaceae: *Steccherinum ochraceum* (Pers.) S. F. Gray.

Polyporaceae: *Ganoderma applanatum* (Pers. ex Wallr.) Pat., *G. brownii* (Murr.) Gilb., *G. lobatum* (Schw.) Atk., *G. lucidum* (Leys. ex Fries) Karst., *G. zonatum* Murr., *G. curtisii* Murr., *G. oregonense* Murr., *G. tsugae* Murr., *Ganoderma* spp. (several unidentified species).

Fomes robiniae (Murr.) Sacc. & Sacc., *F. conchatus* (Pers. ex Fries) Gill., *F. igniarius* (L. ex Fries) Kickx, *F. fomentarius* (L. ex Fries) Kickx, *F. scleroderme us* (Lev.) Cooke, *F. cajanderi* Karst., *F. fraxinophilus* (Peck) Cooke, *F. pinicola* (Swartz ex Fries) Cooke, *F. annosus* (Fries) Karst.

Daedalea unicolor Bull. ex Fries, *D. ambigua* Berk.

Lenzites betulina (L. ex Fries) Fries, *L. striata* (Swartz ex Fries) Fries, *L. saepiaria* (Wulf. ex Fries) Fries.

Trametes mollis (Sommerf.) Fries, *T. hispida* Bagl., *T. corrugata* (Pers.) Bres.

Poria versipora (Pers.) Rom., *P. nigra* (Berk.) Cooke.

Polyporus squamosus Mich. ex Fries, *P. sanguineus* L. ex Fries, *P. sulphureus* Bull. ex Fries, *P. adustus* Willd. ex Fries, *P. fumosus* Pers. ex Fries, *P. supinus* Swartz ex Fries, *P. abietinus* Dicks. ex Fries, *P. pargamenus* Fries, *P. sector* Ehrenb. ex Fries, *P. versicolor* L. ex Fries, *P. maximus* (Mont.) Overh., *P. hirsutus* Wulf. ex Fries, *P. occidentalis* Klotz., *P. spraguei* Berk. & Curt., *P. iodinus* Mont., *P. gilvus* (Schw.) Fries, *P. licnoides* Mont., *P. radiatus* Sow. ex Fries, *P. hydnoides* Swartz ex Fries.

The genus *Ganoderma* is a natural grouping of fairly closely related forms, but many tropical and subtropical species are very difficult to identify; for this reason records of unidentified *Ganoderma* have been included in the host data. Some authorities consider *G. brownii* and *G. zonatum* to be varieties of *G. applanatum* and *G. lucidum* respectively. All of the other genera appear to be heterogeneous assemblages, and records from "*Polyporus* sp." or "*Fomes* sp." have been disregarded. *Fomes robiniae*, *F. conchatus*, and *F. igniarius* are similar in having brownish sporophores (and mycelial mats), and Nobles (1958) has grouped them together with brownish species of *Polyporus*, such as *P. gilvus*, *P. iodinus*, and *P. licnoides*. *Fomes fomentarius* and *F. scleroderme us* are very closely related species occurring in the northern and southern states, respectively. *Polyporus versicolor*, *P. hirsutus*, *P. occidentalis*, and *P. maximus* are similar in having relatively thin, whitish sporophores with a trimitic hyphal system, and on the basis of cultural and other characters they are thought to be related to *Lenzites betulina*, *Trametes hispida*, and *Daedalea ambigua*. *Polyporus pargamenus* and its close relatives *P. sector* and *P. abietinus* are also thought to belong to the *P. versicolor* group, but they appear to be preferred by different ciids.

The following outline of host preference groups must be tentative, since it involves only the 17 species of North American *Ceracis*, but it is, for the most part, supported by unpublished data for over 100 species of Nearctic and Neotropical Ciidae.

Polyporus versicolor group. This is essentially the same as the group proposed by Paviour-Smith (1960) with the addition

of a few American species. The only two species of *Ceracis* which definitely prefer this group of fungi are *C. dixiensis*, which is normally found on *Trametes hispida*, and *C. quadricornis*, which occurs on several species, including *P. occidentalis* and *P. hirsutus*. *C. thoracicornis* and *C. californicus* both occur regularly on fungi in this group, but both are rather polyphagous and probably have their "headquarters" in other groups (see below). *C. monocerus* has been taken only on *Polyporus sanguineus*. This fungus differs from *P. versicolor* and its relatives in the shape of the basidiospore and the bright reddish color of the fruiting body, but it would fall into this group on the basis of the hyphal system (Cunningham, 1947) and host records for several Neotropical eiids.

Polyporus pargamenus group. This includes *P. pargamenus*, *P. abietinus*, *P. sector*, and probably *Daedalea unicolor*, all of which have relatively thin sporophores with whitish context and violet to gray or brownish pore surface. The 3 *Ceracis* which seem to prefer these fungi are *C. thoracicornis*, *C. minutissimus*, and *C. powelli*. Although *C. thoracicornis* occurs on a wide variety of hosts, it shows a definite preference for *P. pargamenus* and is a common and characteristic inhabitant of the other species as well. *C. powelli* has been taken only on *P. abietinus* and *P. pargamenus*, while *C. minutissimus* occurs only on *D. unicolor*.

Polyporus gilvus group. A number of fungi with brownish or reddish brown fruiting bodies are included here. Some of these are *Polyporus gilvus*, *P. licnoides*, *Poria nigra*, *Fomes robiniae*, and *F. igniarius*. The 4 species definitely preferring fungi in this group are *C. singularis*, *C. obrieni*, *C. punctulatus*, and *C. pullulus*. Some of these beetles also breed in *Polyporus hydnoides* and certain *Ganoderma*, which have brownish sporophores, but which are usually inhabited by a different group of beetles (see below).

Ganoderma applanatum group. This corresponds to Paviour-Smith's second host preference group, characterized by the dimitic or monomitic hyphal system, and includes most of the remaining fungi, for which there are adequate host records. The beetles included are: *Ceracis sallei*, *C. schaefferi*, *C. minutus*, *C. multipunctatus*, *C. nigropunctatus*, *C. curtus*, and *C. californicus*. *C. sallei* occurs almost exclusively on *Ganoderma applanatum*, while *C. multipunctatus* is usually found on *G. zonatum*. *C. nigropunctatus* and *C. curtus* both occur on *Fomes sclerodermeus* and *Polyporus hydnoides*. *C. minutus* and *C. schaefferi* are doubtfully included on the basis of a single record on *Ganoderma*. *C. californicus* is another species with a wider host range, but it appears to prefer the species of *Ganoderma* as well as *Polyporus adustus*, which also falls into this group.

The placing of fungi and beetles into distinct groups is obviously an oversimplification, but it does serve to bring to light certain patterns of host preference. There are probably several characteristics of the fungus sporophore which are involved in host selection, two of these being chemical composition (as reflected in the color) and texture (which is probably connected with the complexity of the hyphal system). Some beetle species will be less host specific than others and may occur on fungi in several groups. A satisfactory analysis of host preference phenomena must take into account several other factors, such as the condition of fruiting bodies (wet or dry, fresh or decomposed), host range and relative abundance of the fungi, geographic distribution of the fungi and the beetles, and the presence of closely related or competing beetle species in any particular area. Some of these will be considered in the discussions of individual species.

Key to the Species of *Ceracis* Occurring in in North America

Males

1) Apex of pronotum rounded or weakly emarginate, without distinct tubercles, horns, or lamina ..... 2)

— Apex of pronotum produced, forming a lamina, or 2 tubercles or horns ..... 6)

2) Frontoclypeal ridge produced, forming a long and narrow, median horn; pronotal and elytral punctation very fine and sparse ..... *C. monocerus*, new name

— Frontoclypeal ridge simple, or forming 2 rounded plates or tubercles; elytral punctation much coarser and denser than pronotal punctation ..... 3)

3) Abdominal pore transverse, and at least 0.50 × as long as body of sternite III ..... 4)

— Abdominal pore circular, and less than 0.40 × as long as body of sternite III ..... 5)

4) Size larger, TL more than 1.40 mm; frontoclypeal ridge simple; pronotal disc strongly declined anteriorly, the apex rounded; elytra expanded near apices ..... *C. obrieni*, n. sp.

— Size smaller, TL less than 1.40 mm; frontoclypeal ridge forming 2 tubercles; pronotal disc only weakly declined anteriorly, the apex shallowly emarginate; elytra subparallel ..... *C. dixiensis* (Tanner)

5) Body longer and narrower, EL/EW more than 1.45; EL/PL more than 1.85; pronotal apex very shallowly emarginate; elytral punctation dual and confused; southern Arizona ..... *C. powelli*, n. sp.

— Body shorter and broader, EL/EW less than 1.45; EL/PL less than 1.85; pronotal apex rounded; elytral punctation single and uniform; Florida ..... *C. multipunctatus* (Mellié)

6) Elytral punctation distinctly seriate; antennae 9- or 10-segmented ..... 7)

— Elytral punctation not distinctly seriate; if subseriate, then antennae 8-segmented ..... 8)

7) Antennae 10-segmented; pronotal apex bearing 2 horns, each with a distinct knob above; abdominal pore slightly transverse ..... *C. singularis* (Dury)

— Antennae 9-segmented; pronotal apex with 2 flattened horns; abdominal pore circular ..... *C. pullulus* (Casey)

8) Elytral punctation single and uniform, very coarse and dense; body shorter and broader, EL/EW less than 1.35; antennae 9-segmented ..... 9)

— Elytral punctation distinctly dual, the punctures usually falling into 2 size classes; if obscurely dual, then EL/EW more than 1.35 or antennae 8-segmented ..... 10)

9) Size larger, TL usually more than 1.50 mm; sides of elytra somewhat rounded; body somewhat shorter and broader; surfaces of pronotum and elytra smooth ..... *C. curtus* (Mellié)

— Size smaller, TL usually less than 1.50 mm; sides of elytra subparallel; body somewhat longer and narrower; surfaces of pronotum and elytra lightly granulate ..... *C. nigropunctatus*, n. sp.

10) Antennae 9-segmented ..... 11)

— Antennae 8-segmented ..... 12)

11) Apex of pronotum with a deeply emarginate lamina or 2 flattened, subtriangular horns; elytral punctation coarser and denser, the punctures usually separated by less than 0.75 diameter; western North America ..... *C. californicus* (Casey)

— Apex of pronotum with 2 distinctly tumid, narrow, diverging horns; elytral punctation finer and sparser, the punctures usually separated by 0.75 diameter or more; eastern North America ..... *C. thoracicornis* (Ziegler)

12) Body longer and narrower, TL/EW more than 2.40; apex of pronotum with 2 narrow, diverging horns ..... *C. quadricornis* Gorham

— Body shorter and broader, TL/EW less than 2.40; apex of pronotum with a short, broad lamina or 2 flattened, subtriangular horns or teeth ..... 13)

13) Elytral punctation much coarser and denser than pronotal punctation ..... 14)

— Elytral punctation as fine and sparse as or finer and sparser than pronotal punctation ..... 15)

14) Size larger, TL usually more than 1.30 mm; EL/PL usually less than 1.60; pronotal punctation somewhat coarser and denser, the punctures usually more than 0.10 × as large as scutellar base and separated by 1.5 diameters or less; pronotal apex with a short, broad, elevated lamina; color usually uniformly reddish, southern Texas ..... *C. schaefferi* Dury

— Size smaller, TL usually less than 1.30 mm; EL/PL usually more than 1.60; pronotal punctation somewhat finer and sparser, the punctures usually less than 0.10 × as large as scutellar base and separated by more than 1.5 diameters; pronotal apex with 2 approximate, triangular teeth; color blackish or dark brown, with pronotal apex yellowish; eastern North America ..... *C. minutissimus* (Mellié)

15) Size smaller, TL less than 1.5 mm; abdominal pore less than 0.33 × as long as body of sternite III; pronotal apex with 2 subparallel or slightly diverging, narrow horns; elytral punctation subseriate ..... *C. minutus* Dury

— Size larger, TL more than 1.5 mm; abdominal pore less than 0.33 × as long as body of sternite III; pronotal apex with a deeply emarginate lamina, giving the appearance of 2 broad, subtriangular horns; elytral punctation confused ..... 16)

16) Pronotal punctation as fine and sparse as elytral punctation, the punctures usually separated by 1 diameter or more; abdominal pore slightly transverse ..... *C. sallei* Mellié

— Pronotal punctation somewhat coarser and denser than elytral punctation, the punctures usually separated by less than 1 diameter; abdominal pore circular ..... 17)

17) Color of elytra uniformly blackish; Florida only ..... *C. punctulatus punctulatus* Casey

— Elytra reddish posteriorly; eastern North America ..... *C. punctulatus rubriculus*, n. ssp.

Females

1) Elytral punctation dual and distinctly seriate, the larger punctures forming relatively straight rows; antennae 9- or 10-segmented ..... 2)

— Elytral punctation not distinctly seriate; if subseriate, then antennae 8-segmented ..... 3)

2) Antennae 10-segmented; size larger, TL usually more than 1.47 mm ..... *C. singularis* (Dury)

— Antennae 9-segmented; size smaller, TL usually less than 1.47 mm ..... *C. pullulus* (Casey)

3) Elytral punctation single and uniform, very coarse and dense; antennae 9-segmented; EL EW less than 1.40 ..... 4)

— Elytral punctation distinctly dual, the punctures falling into 2 size classes; if obscurely dual, then antennae 8-segmented or EL EW more than 1.40 ..... 6)

4) Pronotal punctation finer and sparser, the punctures less than 0.10 × as large as scutellar base and separated by more than 0.75 diameter; pronotal disc strongly declined anteriorly, its surface distinctly granulate and dull, in contrast to the smooth and shiny elytral surface ..... *C. multipunctatus* (Mellié)

— Pronotal punctation coarser and denser, the punctures more than 0.10 × as large as scutellar base and separated by less than 0.75 diameter; pronotal disc not or weakly declined anteriorly, its surface similar in texture to that of elytra ..... 5)

5) Size larger, TL usually more than 1.55 mm; sides of elytra somewhat rounded; pronotum shorter and broader, PL/PW usually less than 0.88; surfaces of pronotum and elytra smooth ..... *C. curtus* (Mellié)

— Size smaller, TL usually less than 1.55 mm; sides of elytra subparallel; pronotum longer and narrower, PL PW usually more than 0.88; surfaces of pronotum and elytra lightly granulate ..... *C. nigropunctatus*, n. sp.

6) Antennae 9-segmented ..... 7)

— Antennae 8-segmented ..... 10)

7) Elytral punctation finer and sparser, the punctures separated by more than 1 diameter; eastern North America ..... 8)

— Elytral punctation coarser and denser, the punctures usually separated by less than 1 diameter; western North America ..... 9)

8) Pronotal punctation very fine and sparse, the punctures less than 0.10 × as large as scutellar base and separated by 1.5 diameters or more; pronotum somewhat shorter and broader, PL PW usually less than 0.91; metasternal suture more than 0.20 × as long as median length of metasternum; pronotum usually lighter in color than elytra ..... *C. monocerus*, new name

— Pronotal punctation coarser and denser, the punctures more than 0.10 × as large as scutellar base and separated by 1.5 diameters or less; pronotum somewhat longer and narrower, PL/PW usually more than 0.91; metasternal suture less than 0.25 × as long as median length of metasternum; elytra and pronotum usually similar in color ..... *C. thoracicornis* (Ziegler)

9) Pronotum distinctly narrowed anteriorly; EL PL more than 1.85; antennal segment III 2.00 × as long as IV ..... *C. powelli*, n. sp.

— Pronotum not distinctly narrowed anteriorly; EL PL less than 1.85; antennal segment III 3.00 × as long as IV ..... *C. californicus* (Casey)

10) EL PL less than 1.60 and elytral punctation much coarser and denser than pronotal punctation; southern Texas ..... *C. schaefferi* Dury

— EL/PL more than 1.60 or elytral punctation not coarser and denser than pronotal punctation ... 11)

11) Pronotal disc strongly declined anteriorly; elytra distinctly expanded near apices; southern Arizona ... *C. obrieni*, n. sp.

— Pronotal disc not or only weakly declined; elytra not expanded near apices ... 12)

12) TL/EW more than 2.35; elytral punctures separated by 0.75 diameter or more, not subconfluent anteriorly; southern Texas ... *C. quadricornis* Gorham

— TL/EW less than 2.35 or elytral punctures separated by less than 0.75 diameter and becoming subconfluent anteriorly ... 13)

13) Elytral punctation coarser and denser than pronotal punctation, the punctures becoming subconfluent anteriorly ... 14)

— Elytral punctation finer and sparser than or as fine and sparse as pronotal punctation, the punctures not subconfluent anteriorly ... 15)

14) Pronotum somewhat shorter and broader, PL/PW usually less than 0.90; antennal segment III 1.50 × as long as IV; eastern North America ... *C. minutissimus* (Mellié)

— Pronotum somewhat longer and narrower, PL/PW usually more than 0.90; antennal segment III 2.00 × as long as IV; western North America ... *C. dixiensis* (Tanner)

15) Size smaller, TL less than 1.10 mm; elytral punctation subseriate; pronotal surface lightly granulate and shiny ... *C. minutus* Dury

— Size larger, TL usually more than 1.10 mm; elytral punctation confused; pronotal surface distinctly granulate and dull ... 16)

16) Pronotal punctation about as fine and sparse as elytral punctation, the punctures usually separated by 1 diameter or more ... *C. sallei* Mellié

— Pronotal punctation coarser and denser than elytral punctation, the punctures usually separated by less than 1 diameter ... 17)

17) Elytra uniformly black; Florida ... *C. punctulatus punctulatus* Casey

— Elytra reddish posteriorly; eastern North America ... *C. punctulatus rubriculus*, n. ssp.

Ceracis californicus (Casey), NEW COMBINATION

Fig. 15

Enneartbron californicum Casey, 1884: 36; Casey, 1898: 89; Dury, 1917: 24; Hatch, 1962: 234, pl. 48, fig. 7. Type locality: "California." Holotype, ♂, Casey Coll., USNM.

Enneartbron convergens Casey, 1898: 89; Dury, 1917: 24. Type locality: "California (Los Angeles)." Holotype, ♂, Casey Coll., USNM. NEW SYNONYMY.

Enneartbron discolor Casey, 1898: 89; Dury, 1917: 24. Type locality: "California (Sonoma Co.)." Holotype, ♂, Casey Coll., USNM. NEW SYNONYMY.

Enneartbron grossulum Casey, 1898: 89; Dury, 1917: 24. Type locality: "California (southern)." Holotype, ♂, Casey Coll., USNM. NEW SYNONYMY.

Enneartbron coloradense Dury, 1917: 22, 24. Type locality: "Grand Lake, Middle Park, Colo." Holotype, ♂, Dury Coll., CIN. NEW SYNONYMY.

Enneartbron oregonus Dury, 1917: 22, 24; Hatch, 1962: 235 (syn.). Type locality: "Corvallis, Oregon." Holotype, ♂, Dury Coll. CIN.

Plesiotypes.— ♂ and ♀, CALIFORNIA: Alpine Lake, Marin Co., Jan. 30, 1960, Lot 523 J. F. Lawrence, ex *Ganoderma brownii* on *Umbellularia californica* [MCZ].

Male.—Length 1.80 mm. Body 2.57 × as long as broad. Head and apex or pronotum reddish, remainder of pronotum dark reddish brown; greater part of elytra blackish, posterior third reddish mesially; ventral surfaces blackish; legs and antennal club yellowish brown, antennal funicle and palpi yellowish. Vertex with a deep, transverse impression, preceded by a median elevation; frontoclypeal ridge produced, forming a relatively long, slightly concave lamina, which is shallowly emarginate at apex. Antennae 9-segmented; segment III 3 × as long as IV. Pronotum 1.07 × as long as broad, widest at anterior third; sides sub-parallel; anterior edge produced, forming a flat, slightly elevated lamina, which is deeply emarginate, giving the appearance of 2 slightly divergent, subtriangular horns; disc impressed anteriorly just behind lamina and bearing a short, transverse carina on each side of it; surface distinctly granulate;

punctures about 0.16 × as large as scutellar base and separated by 0.25 to 0.75 diameter. Elytra 1.53 × as long as broad and 1.48 × as long as pronotum; sides subparallel for three-fourths of their lengths and abruptly converging near apices; punctation dual and confused, coarser and denser than pronotal punctation, the punctures usually separated by 0.25 diameter. Metasternum 0.59 × long as wide; suture 0.15 × as long as median length of sternite. Abdomen 0.94 × as long as wide at base; sternite III with a circular, median, setigerous pore, which is 0.23 × as long as body of sternite, distinctly margined, and located posterad of center.

Female.—Length 1.75 mm. Body 2.41 × as long as broad. Vertex slightly convex; frontoclypeal ridge simple. Pronotum 0.96 × as long as broad; anterior edge rounded. Elytra 1.55 × as long as broad and 1.80 × as long as pronotum. Sternite III without a setigerous pore.

Variation.—Color of pronotum reddish orange to black, usually reddish or dark reddish brown with the apex reddish, occasionally reddish mesially and darker laterally; elytra yellowish orange to black, usually reddish or blackish with some reddish posteriorly. Color varies considerably throughout range, and four major patterns are common: all black, all red or reddish brown, black with some reddish on the apex of pronotum and posterior part of elytra, and pronotum reddish with the elytra blackish or black and red. Although all types may be found within a single population, reddish specimens are more common in southern Arizona, while those from the California coast tend to be blackish. Anterior edge of pronotum in smaller males is weakly produced and shallowly emarginate, so that 2 small tubercles or teeth are formed. In larger specimens these are replaced by a distinct lamina, which may have converging, parallel, or slightly diverging sides and which is emarginate to varying degrees, so that 2 distinct teeth or horns are formed. Variation also occurs in the angle of elevation of the lamina and in the degree to which the pronotum is impressed behind it. The length of the plate varies from about 0.10 to 0.25 × the total length of the pronotum. The size and density of pronotal punctures and the granulation of the pronotal surface also exhibit a certain amount of variation. On the whole, northern California specimens tend to have a more distinctly granulate and dull pronotum with coarser and denser punctures than do individuals from southern Arizona. Size and dimensions vary as follows in a series of 14 ♂♂ and 13 ♀♀ from Alpine Lake, Marin Co., California (Lot 523): TLmm ♂ 1.44–1.80 (1.68 ± 0.029), ♀ 1.34–1.73 (1.57 ± 0.032); TL EW ♂ 2.33–2.61 (2.50 ± 0.021), ♀ 2.31–2.56 (2.42 ± 0.019); PL PW ♂ 1.03–1.08 (1.05 ± 0.005), ♀ 0.96–1.04 (1.00 ± 0.008); EL EW ♂ 1.37–1.57 (1.49 ± 0.015), ♀ 1.48–1.61 (1.52 ± 0.014); EL PL ♂ 1.40–1.57 (1.48 ± 0.013), ♀ 1.59–1.80 (1.70 ± 0.019). Total size range in material examined: 1.20–2.06 mm.

Distribution.—Western North America, from Seattle, Washington, east to western Nebraska, south along the Pacific Coast to southern California and through the Great Basin and Rocky Mountains to southern Arizona and New Mexico; extending into Mexico as far south as Baja California del Sur and southern Sinaloa (see Fig. 29). About 1600 specimens have been examined from the following localities: **UNITED STATES**: ARIZONA: Carr Canyon (Huachuca Mts.), 15 mi. E Douglas, Graham Mt., Madera Canyon (Santa Rita Mts.), Miller Canyon (10 mi. W Hereford, Huachuca Mts.), 1 mi. N Nogales, 3 mi. S Patagonia, 4 mi. NE Patagonia, Sabino Canyon (Santa Catalina Mts.), San Francisco Peaks, Southwestern Research Station (5 mi. SW Portal), Rustler Park (8 mi. W Portal); CALIFORNIA: Alpine Lake, Alum Rock Park, Atascadero, Ben Lomond, Berkeley, Big Sur, 9 mi. W Brookdale, Calistoga, Carmel, Carson Ridge, 2 mi. SW Chew's Ridge, Claremont, 14 mi. S Clayton, 1 mi. SE Crystal Lake, Cordelia, Cow Creek (Stan-

islaus National Forest), 10 mi. N Descanso, Dorset Camp (Sequoia National Park), Escondido, Fallbrook, Fresno, Glen Ellen, 6 mi. SE Gorda, Green Valley, Kaweah, Korbel, Lagunitas, Lake Lagunitas, Long Beach, Los Gatos, 2 mi. SE Los Gatos, Los Angeles, Macama Creek, Markwest Springs, Mill Valley, 1.5 mi. N Mt. Laguna, Mt. Tamalpais, Mt. Wilson, Napa, North Hollywood, Oakland, Ojai, Palo Alto, Pasadena, 2 mi. N Piercy, 2 mi. N Placerville, Redwood Glen, 3 mi. N. Refugio Beach, S. P. Taylor State Park, San Diego, San Dimas Canyon, Santa Barbara, Santa Cruz Mts., Santa Monica, Siskiyou Co., 12 mi. W Skagg's Springs, 2 mi. E Sonora, 6 mi. E Stewart's Point, Stockton, 2 mi. E Sveadal, Taylorville, Tilden Park, Twain, Warner's, Wilmington; COLORADO: Denver, Middle Park, Newcastle, 10 mi. S Steamboat Springs; NEBRASKA: 15 mi. W Sydney; NEVADA: 8 mi. SE Lamoille (Ruby Mts.); NEW MEXICO: Silver City; OREGON: Wheatland, Corvallis; UTAH: Aspen Grove, 14 mi. SE Heber, Provo, Salt Lake City, Timpanogas. Utah Lake (east side); WASHINGTON: College Place, 3 mi. S College Place, 5 mi. W College Place, Kooskooskie, Seattle; **MEXICO**: BAJA CALIFORNIA DEL SUR: La Laguna (Sierra Laguna); DURANGO: 3 mi. W El Salto; SINALOA: 8 mi. W El Palmito [AMNH, ANSP, BYU, CAS, CDA, CIN, CIS, CU, INHS, JFL, JS, KU, MCZ, UAL, UAZ, UCD, USNM, UW]. A series of specimens from New Haven, Connecticut, and 3 specimens from Washington, D. C. have probably been mislabeled.

Host fungi.—Polyporus versicolor [27 (7)]; *Polyporus adustus* [11(2)]; *Ganoderma brownii* [8(5)]; *Ganoderma* sp. [6 (3)]; *Lenzites betulina* [6]; *Ganoderma applanatum* [3(2)]; *Trametes hispida* [3 (2)]; *Pleurotus ostreatus* [3(1)]; *Poria versipora* [2(2)]; *Steccherinum ochraceum* [2(1)]; *Polyporus gilvus* [2]; *Ganoderma lucidum* [1(1)]; *Ganoderma lobatum* [1 (1)]; *Polyporus pargamenus* [1(1)]; *Daedalea unicolor* [1(1)]; *Fomes annosus* [1 (1)]; *Fomes fraxinophilus* [1(1)]; *Ganoderma oregonense* [1]; *Fomes cajanderi* [1]; *Trametes mollis* [1].

Discussion.—This is a large, narrow, and elongate species, which does not appear to be closely related to any other known form. It is most similar to *C. powelli*, from which it differs by having coarser, denser, and more uniform elytral punctation, smoother elytral surface, longer 3rd antennal segment, and more pronounced secondary sexual characters in the male. It is also somewhat similar to *C. thoracicornis* from eastern North America, but that species is smaller, with finer and sparser elytral punctation and different pronotal characters in the male.

The considerable variation in color and secondary sexual characters in this species has led to the proposal of several names based on variants which may occur within a single population. Casey (1898) described 3 California species, *Enncarthron convergens*, *E. discolor*, and *E. grossulum*, which were based on minor differences in pronotal punctation and the nature of the pronotal lamina and all of which are synonymous with his earlier name *E. californicum* (Casey, 1884). Dury (1917) described 2 more species, *E. oregonus* from Oregon and *E. coloradense* from Colorado, which also fall within the range of variation of Casey's *californicum*. As noted above, there is a certain amount of geographic variation with respect to color, pronotal punctation, and surface texture, but I do not think this is sufficient to warrant the recognition of subspecies. Dury (1917) mentioned a subspecies from New Mexico, but did not propose a name for it; all of the other names proposed by Casey and Dury refer to variants of the typical northern and coastal form.

C. californicus is a common and widespread species in western North America and is one of the few members of this genus to become established in northern and montane regions, which are dominated by a Holarctic fauna. The species has a very

broad host range; it has been collected on 20 different fungi and apparently breeds in at least 14 of these, the most common hosts being *Polyporus versicolor*, *P. adustus*, and various species of *Ganoderma*. Although the above records suggest that *P. versicolor* is the preferred host, there is some evidence that *Ganoderma applanatum* and its relatives form the "headquarters" for this species. If the several closely related species of *Ganoderma* are taken together, the total number of breeding records exceeds that for *P. versicolor*. Most of the collections of *P. versicolor* were made in northern and coastal California, and there was a definite collecting bias in favor of this fungus, since it is inhabited by several different ciids. Finally, *Ceracis californicus* is more commonly collected on *Ganoderma* in southern Arizona, which probably is closer to the center of its range. If the species originated in northern Mexico, there may have originally been selection pressure in favor of oligophagous feeding habits, since a number of other *Ceracis* occur in this area. The species then spread northward along the Pacific Coast and into the Rocky Mountain Region, where the absence of related species allowed an expansion of the host range.

Whatever its original preferred host may have been, *Ceracis californicus* must be considered a polyphagous species, at least in the northern part of its range. It is interesting that the commonest host fungi fall into both of the host preference groups established by Paviour-Smith (1960) and corroborated by my own unpublished data on the North American ciids. *Polyporus versicolor* and *Leuzites betulina* form part of one group, and *Polyporus adustus* and *Ganoderma* spp. fall into the other. The same is true in the case of *Ceracis thoracicornis* discussed below.

In northern California, *C. californicus* is a common inhabitant of *Ganoderma brownii*, where it may occasionally be found with *Eridanlus ephippiatus* (Mannerheim). In the same area, it is usually associated with *Sulcacis curtulus* (Casey) and *Eridanlus americanus* (Mannerheim) in *Polyporus adustus*, and it occurs with several other ciids, including *Cis vitulus* Mannerheim, *Cis versicolor* Casey, *Cis fuscipes* Mellié, and *Octotemnus laevis* Casey in *Polyporus versicolor* and its relatives. In Nevada and Utah, the species has been taken in *Ganoderma applanatum*. In southern Arizona and northern Mexico, it is usually found in various species of *Ganoderma*, including *G. lobatum* and *G. lucidum*, and it may occur in *Trametes hispida* as well. In this last area, there are 4 sympatric species of *Ceracis*, each of which occurs on a different group of fungi: *C. californicus* on *Ganoderma*, *C. dixiensis* on *Trametes hispida*, *C. powelli* on *Polyporus abietinus* and the related *P. pargamenus*, and *C. obrieni* on *Polyporus gilvus*.

Ceracis curtus (Mellié), NEW COMBINATION

Enmearthron curtum Mellié, 1848: 367, pl. 12, fig. 15; Jacquelin DuVal, 1857: 243. Type locality: "Havane." Lectotype, ♂, Pic Coll. (Chevrolat Coll.), MNHN.

Cis obesus Mellié, 1848: 335, pl. 11, fig. 13. Type locality: "Amerique boreale." Lectotype, ♂, Melly Coll., GEN. NEW SYNONYMY.

Enmearthron compacta Dury, 1917: 21, 24. Type locality: "Key West, Fla." Holotype, ♂, Dury Coll., CIN. NEW SYNONYMY.

Plesiotypes.— ♂ and ♀, CUBA: Soledad (Cienfuegos), V, VI-'39, C. Parsons, coll. [MCZ].

Male.—Length 1.50 mm. Body 1.93 × as long as broad. Head and apex of pronotum reddish, remainder of pronotum black; elytra and ventral surfaces dark reddish brown; legs, antennal funicle, and palpi yellowish brown, antennal club dark brown. Vertex with a weak, transverse impression, preceded by a median elevation; frontoclypeal ridge weakly produced and shallowly emarginate, forming 2 small, rounded tubercles. Antennae 9-segmented; segment III 2.25 × as long as IV. Pronotum 0.83 × as long as broad, widest at middle; sides

strongly rounded; anterior edge weakly produced and shallowly emarginate, forming 2 rounded, slightly elevated tubercles; surface very lightly granulate, almost smooth; punctures about 0.18 × as large as scutellar base and separated by 0.25 to 0.50 diameter. Elytra 1.16 × as long as broad and 1.50 × as long as pronotum; sides weakly rounded and slightly diverging for two-thirds of their lengths and abruptly converging at apices; punctation single and relatively uniform, coarser and somewhat denser than pronotal punctation, the punctures usually separated by 0.25 diameter. Metasternum 0.38 × as long as wide; suture absent. Abdomen 0.71 × as long as broad; sternite III with a circular, median, setigerous pore, which is 0.43 × as long as body of sternite, distinctly margined, and located posterad of center.

Female.—Length 1.90 mm. Body 2.05 × as long as broad. Vertex slightly convex; frontoclypeal ridge simple. Pronotum 0.83 × as long as broad; anterior edge rounded. Elytra 1.27 × as long as broad and 1.62 × as long as pronotum. Sternite III without a setigerous pore.

Variation.—Color of pronotum yellowish orange to black, usually blackish, less commonly reddish brown; elytra yellowish to black, usually reddish or reddish brown, with the base dark brown or black. The elytra are commonly lighter in color than the pronotum. Forms with bicolored elytra occur in the same populations with those having the elytra uniformly reddish brown or blackish. Pronotal tubercles in smaller males are barely developed, while in larger specimens they may be distinctly elevated and subacute at the apices. Size and dimensions vary as follows in a mixed lot of 14 ♂♂ and 14 ♀♀: TLmm: ♂ 1.42–1.97 (1.68 ± 0.050), ♀ 1.57–2.05 (1.79 ± 0.045); TL/EW ♂ 1.93–2.11 (2.02 ± 0.015), ♀ 1.91–2.12 (2.03 ± 0.015); PL/PW ♂ 0.79–0.91 (0.84 ± 0.009), ♀ 0.78–0.88 (0.85 ± 0.008); EL/EW ♂ 1.16–1.28 (1.21 ± 0.009), ♀ 1.20–1.29 (1.24 ± 0.009); EL/PL ♂ 1.39–1.61 (1.50 ± 0.022), ♀ 1.50–1.68 (1.58 ± 0.015). Total size range in material examined: 1.42 to 2.05 mm.

Distribution.—Southern United States, from south-central Texas to Florida, and the Greater Antilles from Cuba to Puerto Rico (see Fig. 30). About 80 specimens examined from the following localities: **UNITED STATES**: FLORIDA: Key West; PENNSYLVANIA: Philadelphia; TEXAS: Round Mt.; **WEST INDIES**: CUBA: Soledad (Cienfuegos), Cayamas, Havana; DOMINICAN REPUBLIC: St. Domingo, San Francisco Mts.; JAMAICA: Mandeville, Port Antonio; PUERTO RICO: Adjuntas. A series of 9 specimens collected in Philadelphia in 1898 may represent an isolated northern population, but the record is more likely to be an error. [AMNH, ANSP, CIN, MCZ, MNHN, USNM.]

Host fungi.—Fomes scleroderméus [1], *Polyporus hydnoides* [1].

Discussion.—This is one of the largest and the most robust of the North American *Ceracis*. It is very similar to *C. nigropunctatus* in general form, antennal segmentation, and pronotal and elytral punctation, but it differs from that species in its larger size, shorter pronotum, and smooth and shiny surface. It is also quite similar to the West Indian *C. castaneipennis*, which is smaller and has 8-segmented antennae. The species has most often been confused with *C. multipunctatus* in collections, but the latter has much finer pronotal punctation and a rounded pronotal apex and smaller abdominal pore in the male.

The species was originally described by Mellié (1848) as *Enmearthron curtum* from "Havane" and *Cis obesus* from "Amerique boreale"; Dury (1917) redescribed it as *E. compacta* on the basis of material from Key West, Florida, and Round Mountain, Texas. The types of all three species are definitely conspecific.

Part of Dury's type species was bred from *Fomes marmoratus* (= *Fomes scleroderméus*), and 3 specimens from Santo Domingo were apparently collected on *Pogonomyces hydnoides* (= *Polyporus hyd-*

noides). These are the only two host records known at present for this species.

C. curtus is obviously closely related to *C. nigropunctatus*, and the two species have been taken on the same species of fungi. Although the two occur together along the Gulf Coast of Texas, they are allopatric throughout most of their ranges. *C. curtus* is primarily a West Indian species and has been collected only a few times in North America; *C. nigropunctatus*, on the other hand, seems to be fairly common in Louisiana and Texas and extends through Mexico and Central America as far south as Panama. The scattered and rare occurrences of *C. curtus* in North America may indicate a relatively recent dispersal from the West Indies, possibly through the action of hurricanes. Further collecting in parts of Texas should determine whether or not it is established there and if it is reproductively isolated from *C. nigropunctatus*.

Ceracis dixiensis (Tanner), NEW COMBINATION

Octotemnus dixiensis Tanner, 1934: 47. Type locality: "Zion Nat'l. Park, Utah." Holotype, ♂, Tanner Coll., BYU.

Plesiotypes.— ♂ and ♀, ARIZONA: 15 mi. E Douglas, Cochise Co., Aug. 5, 1961, Lot 906 J. F. Lawrence, ex *Trametes hispida* on *Populus Fremontii* [MCZ].

Male.—Length 1.40 mm. Body 2.24 × as long as broad. Head and apex of pronotum reddish, remainder of pronotum dark reddish brown; elytra and ventral surfaces black; legs, antennal funicle, and palpi yellowish brown, antennal club dark brown. Vertex somewhat flattened; frontoclypeal ridge barely produced and emarginate, forming 2 weak, rounded tubercles. Antennae 8-segmented; segment III 2 × as long as IV. Pronotum 0.95 × as long as broad, widest just behind middle; sides weakly rounded; anterior edge weakly produced and emarginate; surface lightly granulate; punctures about 0.09 × as large as scutellar base and separated by 1.0 to 1.5 diameters. Elytra 1.40 × as long as broad and 1.67 × as long as pronotum; sides subparallel for three-fourths of their lengths, gradually converging near apices; punctation dual and confused, coarser and denser than pronotal punctation, the punctures usually separated by less than 0.75 diameter, becoming confluent anteriorly, so that the surface appears rugose. Metasternum 0.50 × as long as wide; suture 0.20 × as long as median length of sternite. Abdomen 0.87 × as long as wide at base; sternite III with a transverse, median, setigerous pore, which is 0.69 × as long as wide, 0.55 × as long as body of sternite, indistinctly margined, and located just posterad of center.

Female.—Length 1.25 mm. Body 2.17 × as long as broad. Vertex as in male; frontoclypeal ridge simple. Pronotum 0.95 × as long as broad; anterior edge rounded. Elytra 1.39 × as long as broad and 1.78 × as long as pronotum. Sternite III without a setigerous pore.

Variation.—Pronotum yellowish orange to black, usually dark reddish brown or blackish, often with the apex reddish; elytra yellowish to black, usually black and occasionally reddish posteriorly near the suture. Anterior edge of pronotum varies slightly in the depth of the emargination, so that small males are almost indistinguishable from females on the basis of this character. Size and dimensions vary as follows in a series of 17 ♂ ♂ and 11 ♀ ♀ from 15 mi. E Douglas, Arizona (Lot 906): TLmm: ♂ 1.13–1.34 (1.23 ± 0.018), ♀ 1.13–1.30 (1.21 ± 0.013); TL EW ♂ 2.17–2.35 (2.26 ± 0.014), ♀ 2.17–2.35 (2.30 ± 0.015); PL PW ♂ 0.89–1.00 (0.95 ± 0.007), ♀ 0.89–1.00 (0.96 ± 0.009); EL EW ♂ 1.36–1.50 (1.42 ± 0.011), ♀ 1.39–1.54 (1.47 ± 0.014); EL PL ♂ 1.61–1.82 (1.70 ± 0.014), ♀ 1.63–2.00 (1.78 ± 0.030). Total size range in material examined: 1.01–1.39 mm.

Distribution.—Southwestern North America, from southern Utah to Guadalajara, Mexico, and from the Colorado River in California to the Big Bend Region in Texas (see Fig. 33). About 200 specimens have

been examined from the following localities: **UNITED STATES**: ARIZONA: 15 mi. E Douglas, 1 mi. N Nogales, 4 mi. NE Patagonia, 5 mi. SE Wickenburg; CALIFORNIA: 4 mi. E Blythe; NEW MEXICO: Dona Ana; TEXAS: Boquillas Camp (Big Bend National Park); UTAH: St. George, 3 mi. E Virgin, Zion National Park; **MEXICO**: JALISCO: Guadalajara. [BYU, CIN, CM, JFL, MCZ, USNM.]

Host fungi.—*Trametes hispida* [7(6)]; *Ganoderma* sp. [2].

Discussion.—This is a small, moderately elongate species with weakly developed pronotal and frontoclypeal characters in the male. In general appearance, it is similar to *C. powelli*, from which it differs by having 8-segmented antennae, finer pronotal punctation, and a larger abdominal pore. *C. obrieni* is the only other species with a large, transversely oval, abdominal pore in the male, but it differs from *C. dixiensis* in its much larger size and apically expanded elytra.

C. dixiensis occurs in the more arid portions of the Southwest, and it is normally found along river beds at low or middle elevations, in association with *Trametes hispida*, a common fungus on cottonwoods and willows. It is commonly associated with *Cis versicolor*, and in southern Arizona it has been collected with *Ceracis californicus* on both *T. hispida* and *Ganoderma* sp. The species has been collected in Jalisco and probably occurs throughout northern Mexico.

Ceracis minutissimus (Mellié), NEW COMBINATION
Fig. 18

Cis minutissimus Mellié, 1848: 334, pl. 11, fig. 12. Type locality: "Boston." Holotype, ♂, Pic Coll. (Chevrolat Coll.), MNHN.

Plesiotypes.— ♂ and ♀, MICHIGAN: Lapeer State Game Area, Lapeer Co., July 3, 1963, Lot 1197 J. F. Lawrence, ex *Daedalea unicolor* [MCZ].

Male.—Length 1.25 mm. Body 2.17 × as long as broad. Head and prothorax dark reddish brown, apex of pronotum brownish yellow; elytra, pectus, and abdomen blackish; legs, antennal funicle, and palpi yellowish, antennal club brownish. Vertex with a moderately deep, transverse impression, preceded by a median elevation; frontoclypeal ridge weakly produced and emarginate, forming 2 rounded tubercles. Antennae 8-segmented; segment III 1.5 × as long as IV. Pronotum 0.90 × as long as broad, widest at middle; sides strongly rounded; anterior edge produced and emarginate, forming 2 small, slightly elevated, approximate, triangular teeth; surface distinctly granulate; punctures about 0.05 × as large as scutellar base and separated by 1.5 to 2.5 diameters. Elytra 1.35 × as long as broad and 1.63 × as long as pronotum; sides weakly rounded, gradually diverging to about middle and converging posteriorly; punctation dual and confused, coarser and denser than pronotal punctation, the punctures usually separated by 0.75 diameter or less, becoming confluent anteriorly so that the surface appears rugose. Metasternum 0.50 × as long as wide; suture 0.17 × as long as median length of sternite. Abdomen 0.89 × as long as wide at base; sternite III with a circular, median, setigerous pore, which is 0.22 × as long as body of sternite, distinctly margined, and located posterad of center.

Female.—Length 1.25 mm. Body 2.17 × as long as broad. Vertex somewhat flattened; frontoclypeal ridge simple. Pronotum 0.86 × as long as broad; anterior edge rounded. Elytra 1.39 × as long as broad and 1.78 × as long as pronotum. Sternite III without a setigerous pore.

Variation.—Color of pronotum yellowish orange to black, usually dark reddish brown, almost always yellowish at apex; elytra yellowish to black, usually black, often somewhat reddish posteriorly along the suture. Anterior edge of pronotum barely produced in smaller males; distinctly produced in larger individuals, so that 2 distinct teeth are formed. Size and dimensions vary as

follows in a series of 22 ♂♂ and 23 ♀♀ from Lapeer Co., Michigan (Lot 1197): TLmm. ♂ 1.15–1.32 (1.22 ± 0.011), ♀ 1.00–1.32 (1.21 ± 0.016); TL EW ♂ 2.00–2.29 (2.12 ± 0.013), ♀ 2.00–2.24 (2.11 ± 0.013); PL PW ♂ 0.84–0.95 (0.88 ± 0.006), ♀ 0.81–0.90 (0.85 ± 0.006); EL EW ♂ 1.26–1.48 (1.33 ± 0.011), ♀ 1.28–1.43 (1.36 ± 0.009); EL PL ♂ 1.55–1.82 (1.68 ± 0.017), ♀ 1.68–1.94 (1.82 ± 0.013). Total size range in material examined: 0.97–1.42 mm.

Distribution.—Eastern United States from New Hampshire and Michigan to Alabama (see Fig. 32). More common in the northern part of the range, and to be expected in southern Canada. About 375 specimens have been examined from the following localities: ALABAMA: Mobile; INDIANA: La Porte Co., Smith Station; KENTUCKY: Mammoth Cave National Park; MASSACHUSETTS: Sherborn, Cambridge, Concord, Boston, Melrose, Stoneham; MICHIGAN: Lapeer State Game Area; NEW HAMPSHIRE: 7 mi. NW Wilton; NEW JERSEY: Morristown; OHIO: Cincinnati; PENNSYLVANIA: Chestnut Hill, Easton, Wissahickon Cr. [AMNH, CAS, CIN, CNC, CNHM, CU, HH, INHS, JFL, JS, MCZ, MNHN, UAL, UCD, USNM.]

Host fungi.—*Daedalea unicolor* [7(5)]; *Polyporus versicolor* [1]; *Polyporus adustus* [1].

Discussion.—This is one of the smaller species in the genus and is similar in size and general appearance to *C. minutus*, from which it may be distinguished by the coarser and denser elytral punctation, distinctly granulate and dull pronotal surface, and the presence of 2 approximate, triangular teeth on the pronotum of the male. It may be confused with smaller males and females of *C. thoracicornis*, but in the latter species the antennae are 9-segmented and the elytral punctation is finer and sparser.

Although specimens have been taken in Mobile, Alabama, the species appears to be more common in northeastern North America, where it normally feeds on the fungus *Daedalea unicolor*.

Ceracis minutus Dury
Fig. 19

Ceracis minuta Dury, 1917: 25. Type locality: "Palm Beach, Florida." Holotype, ♂, Dury Coll., CIN.

Plesiotypes.— ♂ and ♀, TEXAS: Brownsville, H. S. Barber, coll., ex *Ganoderma pseudoboletus* [USNM].

Male.—Length 1.12 mm. Body 2.14 × as long as broad. Head and apex of pronotum reddish; remainder of pronotum, elytra, and ventral surfaces dark reddish brown; legs, antennal funicle, and palpi yellowish, antennal club brownish. Vertex with a moderately deep, transverse impression, preceded by a median elevation; frontoclypeal ridge produced, forming a short, broad, slightly concave lamina, which is shallowly emarginate at apex. Antennae 8-segmented; segment III 2.25 × as long as IV. Pronotum 0.95 × as long as broad, widest at middle; sides weakly rounded; anterior edge produced and deeply emarginate, forming 2 subparallel, slightly elevated horns, which are narrowly rounded at apices; disc slightly impressed just behind horns; surface lightly granulate; punctures about 0.12 × as large as scutellar base and separated by 1.0 to 1.5 diameters. Elytra 1.24 × as long as broad and 1.37 × as long as pronotum; sides weakly rounded, diverging to about middle and gradually converging apically; punctation dual and subseriate, about as coarse and dense as pronotal punctation, the punctures usually separated by 1 diameter or more. Metasternum 0.44 × as long as wide; suture absent. Abdomen 0.76 × as long as wide at base; sternite III with a circular, median, setigerous pore, which is 0.20 × as long as body of sternite, indistinctly margined, and located posterad of center.

Female.—Length 1.02 mm. Body 2.16 × long as broad. Vertex somewhat flattened; frontoclypeal ridge simple. Pronotum 0.94 × as long as broad; anterior edge rounded.

Elytra 1.32 × as long as broad and 1.56 × as long as pronotum. Sternite III without a setigerous pore.

Variation.—Color of pronotum yellowish orange to dark reddish brown, usually reddish or dark reddish brown, with the apex reddish; elytra yellowish to blackish, usually dark reddish brown, often with some reddish posteriorly near the suture. Anterior edge of pronotum in smaller males weakly produced and emarginate, forming 2 flattened, approximate teeth; in larger specimens, these are represented by longer, rounded horns, which are usually subparallel. Size and dimensions vary as follows in a series of 14 ♂ ♂ and 14 ♀ ♀ from Brownsville, Texas: TLmm: ♂ 0.92–1.12 (1.00 ± 0.013), ♀ 0.85–1.10 (0.97 ± 0.016); TL/EW ♂ 2.10–2.21 (2.14 ± 0.009), ♀ 2.05–2.17 (2.09 ± 0.011); PL/PW ♂ 0.87–0.94 (0.90 ± 0.007), ♀ 0.82–0.94 (0.88 ± 0.008); EL/EW ♂ 1.24–1.35 (1.28 ± 0.009), ♀ 1.25–1.39 (1.31 ± 0.010); EL/PL ♂ 1.41–1.64 (1.51 ± 0.017), ♀ 1.56–1.79 (1.66 ± 0.019). Total size range in material examined: 0.80–1.17 mm.

Distribution.—Southern Texas, Florida, and the Greater Antilles (see Fig. 33). About 175 specimens examined from the following localities: **UNITED STATES**: FLORIDA: Enterprise, Biscayne, Palm Beach, West Palm Beach, Key West; TEXAS: Brownsville; **WEST INDIES**: CUBA: Cayamas, Soledad (Cienfuegos); HAITI: Carrefour, Camp Perrin, Etang Sumatre, Port au Prince; JAMAICA: Port Antonio, Sav-la-Mar. [ANSP, BMNH, CIN, CM, MCZ, MNHN, USNM.]

Host fungi.—*Ganoderma* sp. [1].

Discussion.—This is the smallest species of *Ceracis* in the North American fauna and it differs from *C. minutissimus* in having 2 narrow pronotal horns in the male, finer and sparser elytral punctation, which tends to be subseriate, and a more lightly granulate and shiny pronotal surface. It is also very similar to the West Indian *C. variabilis* and the Mexican *C. militaris*. *C. variabilis* is a more narrow and elongate species with coarser and denser punctation. Further notes on this species group are given in a previous section.

Ceracis minutus is primarily a West Indian species, and it extends only into southern Florida and extreme southern Texas. The Texas series was apparently collected on "*Ganoderma pseudoboletus*" along with a series of *C. quadricornis* and *C. schaefferi*. The name *G. pseudoboletus* could not be traced in the mycological literature, but it probably represents one of the stipitate species of *Ganoderma*, such as *G. curtisii* or *G. lucidum*.

Ceracis monocerus, NEW NAME
Fig. 20

Enmcarthron unicorne Casey, 1898: 90; Dury, 1917: 25. (Not *Ceracis unicornis* Gorham, 1898: 332). Type locality: "Florida." Holotype, ♂, Casey Coll., USNM.

Plesiotypes.— ♂ and ♀, FLORIDA: 4 mi. SE Lake Placid, Highlands Co., June 30, 1965, Lot 1532 J. F. Lawrence, ex *Polyporus sanguineus* [MCZ].

Male.—Length 1.25 mm. Body 2.17 × as long as broad. Head and prothorax reddish orange; elytra blackish anteriorly, yellowish posteriorly near the suture; pectus dark brown, abdomen yellowish brown; legs, antennal funicle, and palpi yellowish, antennal club brownish. Vertex with a broad, shallow, median impression; frontoclypeal ridge strongly produced, forming a long and narrow, slightly elevated, flattened, median horn, which is subtruncate at apex. Antennae 9-segmented; segment III 1.33 × as long as IV. Pronotum 0.82 × as long as broad, widest at middle; sides weakly rounded; anterior edge barely emarginate; surface distinctly granulate; punctures about 0.07 × as large as scutellar base and separated by 1.5 to 2.5 diameters. Elytra 1.39 × as long as broad and 1.78 × as long as pronotum; sides weakly rounded, diverging to about middle and gradually converging apically; punctation dual and confused, somewhat finer and about as dense as pronotal

punctation. Metasternum 0.50 × as long as wide; suture 0.44 × as long as median length of sternite. Abdomen 0.94 × as long as wide at base; sternite III with a circular, median, setigerous pore, which is 0.23 × as long as body of sternite, indistinctly margined, and located posterad of center.

Female.—Length 1.22 mm. Body 2.33 × as long as broad. Vertex somewhat flattened; frontoclypeal ridge simple. Pronotum 0.90 × as long as broad; anterior edge rounded. Elytra 1.48 × as long as broad and 1.72 × as long as pronotum. Sternite III without a setigerous pore.

Variation.—Color of pronotum yellowish orange to dark reddish brown, usually reddish orange or reddish brown; elytra yellowish to black, usually blackish or brownish with varying amounts of yellowish or reddish posteriorly near the suture, the yellowish color occasionally occupying more than half of the dorsal surface. Frontoclypeal ridge in smaller males with a very short median projection; in larger specimens this is represented by a long, narrow horn, which is elevated and may extend well beyond the edge of the pronotum. The horn may be narrowly rounded, truncate, or expanded and shallowly emarginate at apex. Anterior edge of pronotum in males may be rounded to shallowly emarginate. Size and dimensions vary as follows in a series of 14 ♂ ♂ and 14 ♀ ♀ from Florida: TLmm: ♂ 1.00–1.30 (1.19 ± 0.021); ♀ 1.15–1.30 (1.23 ± 0.013); TL EW ♂ 2.10–2.26 (2.18 ± 0.013); ♀ 2.14–2.28 (2.21 ± 0.014); PL PW ♂ 0.82–0.90 (0.86 ± 0.007); ♀ 0.84–0.90 (0.88 ± 0.007); EL EW ♂ 1.35–1.43 (1.38 ± 0.007), ♀ 1.36–1.48 (1.41 ± 0.004); EL PL ♂ 1.67–1.86 (1.73 ± 0.016), ♀ 1.72–1.87 (1.77 ± 0.012). Total size range in material examined: 1.00–1.30 mm.

Distribution.—Florida, Louisiana, and Cuba (see Fig. 30). About 65 specimens examined from the following localities: **UNITED STATES**: FLORIDA: 4 mi. SE Lake Placid, LOUISIANA: Killian; **WEST INDIES**: CUBA: no specific locality. [ANSP, JFL, MCZ, USNM.]

Host fungi.—*Polyporus sanguineus* [2 (1)].

Discussion.—As discussed in an earlier section, *C. monocerus* is a member of the *Ceracis furcifer* group, and it is easily distinguished from other North American species by the characters given in the key. It is most closely related to *C. cornifer* from Brazil, *C. hastifer* from Colombia, and *C. unicornis* from the Windward Islands, all of which have 9-segmented antennae and a frontoclypeal horn which is not bifurcate at the apex. *C. monocerus* is known only from Cuba and the extreme southern part of the eastern United States, but this distribution pattern suggests that it may be more widespread in the Greater Antilles. *C. unicornis* Gorham is a very similar form, and further collecting in the West Indies may well show that it is not distinct from *C. monocerus* even at the subspecific level. *C. cornifer* and *C. hastifer* are also very similar to *C. monocerus*, differing mainly in color and in the shape of the frontoclypeal horn and pronotal apex, and may not be specifically distinct.

Two small series of specimens from Florida and Louisiana were collected on the fungus *Polyporus sanguineus*. Both *C. furcifer* and *C. cornifer* have been collected on this same fungus.

The name *monocerus* is taken from the following two Greek words: *monos*, one, and *ceras*, horn.

Ceracis multipunctatus (Mellié), NEW COMBINATION

Fig. 24

Enneanthron multipunctatum Mellié, 1848: 368, pl. 12, fig. 16; Jacquelin DuVal, 1857: 243. Type locality: "Cuba." Location of types unknown.

Plesiotypes.—♂ and ♀, FLORIDA: Highlands Hammock State Park, Highlands Co., June 24, 1965, Lot 1504 J. F. Lawrence, ex *Ganoderma zonatum* [MCZ].

Male.—Length 1.47 mm. Body 2.11 × as long as broad. Head and pronotum black-

ish, apex of pronotum somewhat yellowish; elytra reddish, slightly darker on sides; ventral surfaces reddish brown; legs, antennal funicle, and palpi yellowish brown, antennal club dark brown. Vertex somewhat flattened; frontoclypeal ridge simple and rounded. Antennae 9-segmented; segment III 2 × as long as IV. Pronotum 0.88 × as long as broad, widest at posterior third; sides gradually converging anteriorly; surface distinctly granulate; punctures about 0.08 × as large as scutellar base and separated by 0.75 to 1.25 diameters. Elytra 1.29 × as long as broad and 1.57 × as long as pronotum; sides subparallel for three-fourths of their lengths and abruptly converging near apices; Punctation single and relatively uniform, much coarser and denser than pronotal punctation, the punctures usually separated by 0.50 diameter or less. Metasternum 0.43 × as long as wide; suture barely indicated posteriorly. Abdomen 0.80 × as long as wide at base; sternite III with a circular, median, setigerous pore, which is 0.27 × as long as body of sternite, indistinctly margined, and located posterad of center.

Female.—Length 1.50 mm. Body 2.14 × as long as broad. Vertex and frontoclypeal ridge as in male. Pronotum 0.88 × as long as broad; anterior edge rounded. Elytra 1.32 × as long as broad and 1.61 × as long as pronotum. Sternite III without a setigerous pore.

Variation.—Color of pronotum yellowish orange to black, usually black, with the apex often somewhat yellowish; elytra yellowish to blackish, usually reddish or dark reddish brown, usually unicolored and lighter in color than pronotum. Size and dimensions vary as follows in a series of 23 ♂ ♂ and 20 ♀ ♀ from Highlands Hammock State Park, Florida (Lot 1504): TLmm: ♂ 1.20–1.47 (1.33 ± 0.017), ♀ 1.20–1.50 (1.38 ± 0.018); TL/EW ♂ 2.00–2.12 (2.07 ± 0.009), ♀ 2.04–2.15 (2.09 ± 0.008); PL PW ♂ 0.80–0.92 (0.85 ± 0.006), ♀ 0.80–0.88 (0.84 ± 0.006); EL/EW ♂ 1.23–1.35 (1.29 ± 0.006), ♀ 1.27–1.36 (1.32 ± 0.005); EL PL ♂ 1.55–1.75 (1.64 ± 0.011), ♀ 1.59–1.82 (1.69 ± 0.014). Total size range in material examined: 1.17–1.75 mm.

Distribution.—Alabama, Florida, and the West Indies from Cuba to Montserrat (see Fig. 32). About 175 specimens examined from the following localities: **UNITED STATES**: ALABAMA: Mobile; FLORIDA: 4 mi. NE Copeland, Enterprise, Haulover, Highlands Hammock State Park, 2.5 mi. SE Lake City, 7 mi. SE Lake City, 4 mi. SE Lake Placid; **WEST INDIES**: CUBA: Buenos Aires (Trinidad Mts.), Cayamas, Guantanamo; JAMAICA: Ochos Rios, Mandeville; MONTSERRAT: The Cot. [AMNH, ANSP, CIN, CNHM, JFL, MCZ, USNM.]

Host fungi.—*Ganoderma zonatum* [7(4)]; *Fomes sclerodermeus* [1(1)]; *Polyporus supinus* [1].

Discussion.—This is a very short and broad species in which the pronotal and frontoclypeal modifications are completely lacking in the male. General form and punctation of the elytra are similar to *C. curtus*, *C. nigropunctatus*, and *C. castaneipennis*, but all three of these species have coarser and denser pronotal punctation and distinct tubercles on the pronotal apex in the male. *C. multipunctatus* resembles *C. obrieni* in having a strongly declined and finely and sparsely punctate pronotum, which is rounded in the male, but the latter species has 8-segmented antennae, dual elytral punctation, and a larger, transversely oval abdominal pore.

The identity of this species is still somewhat in doubt. The types should be in the Chevrolat Collection in Paris, but all of the specimens labeled as "multipunctatum" are from Santo Domingo rather than Cuba, and they are conspecific with *C. curtus*. A single specimen in the Marseul Collection is labeled "Ennearthron multipunctatum Mel. Cuba. . . . " and may be from the type series, but the specimen is a female and the pronotal punctation is somewhat coarser than that in the Florida specimens. In comparing the species with *curtus*, Mellié men-

tions that *multipunctatus* has finer punctation, especially on the prothorax. The pronotal punctation of the Marseul specimen is somewhat finer than in specimens of *curtus* but not as fine as that in the specimens here described as *multipunctatus*. Perhaps the examination of more West Indian specimens will clarify this situation.

This is another West Indian species which occurs only in Florida and Louisiana. In central Florida it was found breeding in *Fomes sclerodermeus* and *Ganoderma zonatum*, but it appears to be much more common in the latter.

Ceracis nigropunctatus NEW SPECIES
Fig. 16

Cis punctatus —, Gorham, 1883: 223. Misidentification.

Holotype.— ♂, LOUISIANA: 4 mi. S Grosse Tete, Iberville Parish, Dec. 4, 1965, Lot 1643 J. F. Lawrence, ex *Fomes sclerodermeus* [MCZ, No. 31284]. Allotype, ♀, same data [MCZ].

Male.—Length 1.47 mm. Body 2.18 × as long as broad. Head reddish, pronotum and major portion of elytra blackish, elytral suture reddish brown posteriorly; ventral surfaces reddish brown anteriorly, blackish posteriorly; legs, antennal funicle, and palpi yellowish brown, antennal club dark brown. Vertex with a moderately deep, transverse impression, preceded by a median elevation; frontoclypeal ridge produced and deeply emarginate, forming 2 subtriangular plates. Antennae 9-segmented; segment III 2.50 × as long as IV. Pronotum 0.89 × as long as broad, widest at middle; sides weakly rounded; anterior edge produced, forming 2 small, slightly elevated tubercles, which are separated by slightly more than a basal width; surface weakly granulate; punctures about 0.13 × as large as scutellar base and separated by 0.50 to 0.75 diameter. Elytra 1.30 × as long as broad and 1.46 × as long as pronotum; sides subparallel for most of their lengths, abruptly converging posteriorly; punctation single and relatively uniform, coarser and denser than pronotal punctation, the punctures usually separated by 0.33 diameter or less. Metasternum 0.40 × as long as wide; suture absent. Abdomen 0.83 × as long as wide at base; sternite III with a circular, median, setigerous pore, which is 0.50 × as long as body of sternite, distinctly margined, and located posterad of center.

Female.—Length 1.45 mm. Body 2.19 × as long as broad. Vertex convex; frontoclypeal ridge simple. Pronotum 0.96 × as long as broad; anterior edge rounded. Elytra 1.31 × as long as broad and 1.48 × as long as pronotum. Sternite III without a setigerous pore.

Variation.—Color of pronotum yellowish orange to black, usually dark brown or black; elytra yellowish to black, usually dark brown or black, never distinctly bicolored, but occasionally somewhat reddish posteriorly along the suture. Pronotal tubercles barely developed in smaller males; in larger individuals the tubercles are distinct and elevated and the pronotal disc is often somewhat bulging laterally. Size and dimensions vary as follows in a series of 28 ♂♂ and 21 ♀♀ from 4 mi. S Grosse Tete, Louisiana (Lot 1643): TLmm: ♂ 1.10–1.60 (1.37 ± 0.022), ♀ 1.20–1.55 (1.41 ± 0.018); TL/EW ♂ 2.00–2.26 (2.15 ± 0.011), ♀ 2.07–2.22 (2.14 ± 0.008); PL/PW ♂ 0.82–0.96 (0.89 ± 0.006), ♀ 0.87–0.96 (0.93 ± 0.005); EL/EW ♂ 1.22–1.33 (1.28 ± 0.006), ♀ 1.22–1.33 (1.28 ± 0.006); EL/PL ♂ 1.37–1.67 (1.48 ± 0.012), ♀ 1.38–1.65 (1.49 ± 0.013). Total size range in material examined: 1.07–1.65 mm.

Paratypes.—100, LOUISIANA: same data as holotype [MCZ].

Distribution.—Louisiana and Texas south, through Mexico and Central America, to Panama (see Fig. 27). About 275 specimens examined from the following localities: **UNITED STATES**: LOUISIANA: 4 mi. S Grosse Tete; TEXAS: Columbus, Macdona, Palmetto State Park, San Antonio, Victoria, Wallisville; **MEXICO**: NAYARIT: San Blas; OAXACA: 8 mi. N. La

Ventosa; PUEBLA: 29 mi. E Xilotepec; TAMAULIPAS: Tampico; VERACRUZ: 11 mi. N Cordoba, Cotaxtla Expt. Sta., Cosamoloapan, 9 mi. NE Panuco, Veracruz; **CENTRAL AMERICA**: BRITISH HONDURAS: Manatee District; COSTA RICA: 4 mi. N Canas, Turrialba; EL SALVADOR: Los Choreos National Park; GUATEMALA: 6 mi. E Esquintla, Zapote; PANAMA: Barro Colorado. [BMNH, CAS, CNHM, JFL, MCZ, UCD, USNM.]

Host fungi.—*Polyporus hydnoides* [6(3)]; *Polyporus hirsutus* [2]; *Ganoderma* sp. [1]; *Fomes sclerodermeus* [1(1)].

Discussion.—This is a moderately short and broad species, which is similar to *C. curtus*, differing mainly in its smaller size, somewhat longer pronotum, and lightly granulate surface. It resembles darker specimens of *C. schaefferi* and *C. similis* (southern Baja California and western Mexico), but these two species have 8-segmented antennae, somewhat finer and sparser pronotal punctation, and a short, elevated, pronotal lamina in the male. *C. nigropunctatus* is fairly widely distributed in Mexico and Central America; it appears to exhibit no appreciable geographic variation, and the color of mature specimens is uniformly blackish or mahogany brown throughout the range. The species is sympatric with the closely related *C. curtus* in Texas, although the two have never been taken together.

The beetle has been found breeding in *Fomes sclerodermeus* and *Polyporus hydnoides*, but it appears to be more common in the latter. The 2 records from *P. hirsutus* are based on 1 or 2 specimens and may represent accidental occurrences.

The name *nigropunctatus* is taken from the Latin *niger*, black, and the Neolatin *punctatus*, punctate (originally punctum, a form of the verb *pungo*, to puncture).

Ceracis obrieni NEW SPECIES
Fig. 25

Holotype.—♂, ARIZONA: 2 mi. SW Patagonia, Santa Cruz Co., Sept. 3, 1961, Lot 953 J. F. Lawrence (C. W. O'Brien, coll.), ex *Polyporus gilvus* on *Populus Fremontii* [MCZ, No. 31285]. Allotype, ♀, same data [MCZ].

Male.—Length 1.60 mm. Body 2.06 × as long as broad. Head, pronotum, and posterior half of elytra reddish, anterior half of elytra blackish; ventral surfaces reddish brown; legs, antennal funicle, and palpi yellowish, antennal club brownish. Vertex slightly convex; frontoclypeal ridge simple and rounded. Antennae 8-segmented; segment III 2.33 × as long as IV. Pronotum 0.85 × as long as broad, widest at posterior fifth; sides gradually converging anteriorly; anterior edge strongly rounded; disc declined anteriorly; surface distinctly granulate; punctures about 0.08 × as large as scutellar base and separated by 1.0 to 1.5 diameters. Elytra 1.35 × as long as broad and 1.91 × as long as pronotum; sides gradually diverging posteriorly for three-fourths of their lengths and abruptly converging near apices; punctation dual and somewhat confused, coarser and denser than pronotal punctation, the punctures usually separated by less than 0.75 diameter. Metasternum 0.56 × as long as wide; suture barely indicated posteriorly. Abdomen 0.94 × as long as wide at base; sternite III with a transverse, median, setigerous pore, which is 0.54 × as long as wide, 0.50 × as long as body of sternite, indistinctly margined, and located anterad of center.

Female.—Length 1.85 mm. Body 2.14 × as long as broad. Pronotum 0.84 × as long as broad. Elytra 1.40 × as long as broad and 1.88 × as long as pronotum. Sternite III without a setigerous pore.

Variation.—Color of pronotum yellowish orange to black, usually reddish or reddish brown; elytra yellowish to black, almost always with some reddish posteriorly, and usually black with the posterior half reddish. Size and dimensions vary as follows in a series of 18 ♂♂ and 21 ♀♀ from 2 mi. SW Patagonia, Arizona: TLmm: ♂ 1.42–2.00 (1.70 ± 0.043), ♀ 1.45–1.87 (1.71 ±

0.024); TL EW ♂ 1.97–2.22 (2.09 ± 0.022), ♀ 2.00–2.23 (2.11 ± 0.014); PL PW ♂ 0.77–0.95 (0.87 ± 0.014), ♀ 0.84–0.96 (0.91 ± 0.006); EL EW ♂ 1.28–1.42 (1.36 ± 0.012), ♀ 1.28–1.44 (1.35 ± 0.010); EL PL ♂ 1.71–2.00 (1.86 ± 0.023), ♀ 1.68–2.00 (1.78 ± 0.016). Total size range in material examined 1.42–2.00 mm.

Paratypes.—ARIZONA: 23, same data as holotype [MCZ]; 14, same locality, Jan. 29, 1961, Lot 757 J. F. Lawrence (C. W. O'Brien, coll.), ex *Polyporus gilvus* on *Populus Fremontii* [MCZ].

Distribution.—Southeastern Arizona to southern Sinaloa (see Fig. 29). About 45 specimens examined from the following localities: **UNITED STATES**: ARIZONA: 2 mi. SW Patagonia; **MEXICO**: SINALOA: 8 mi. W El Palmito [MCZ].

Host fungi.—Polyporus gilvus [3(3)].

Discussion.—This is a large and very distinct species in which the elytra are expanded apically and both the pronotum and the frontoclypeal ridge are simple in the male. It is similar to *C. dixiensis* in having a large, transversely oval, abdominal pore, fine and sparse pronotal and coarse and dense elytral punctation, but that species is much smaller with subparallel elytra. *C. multipunctatus* has a similarly declined pronotal disc, which is finely and sparsely punctate and rounded apically in the male, but in that species the antennae are 9-segmented, the elytral punctation is single, and the abdominal pore is smaller and circular.

The species has been collected only in southern Arizona and southern Sinaloa, and in both localities it was breeding in *Polyporus gilvus*, an orange-brown fungus which may represent its headquarters. Although the range of the species traverses the more arid portions of northwestern Mexico, it is probable that *C. obrieni*, unlike *C. dixiensis*, prefers more mesic environments and is absent from most of the intervening area. Both of the localities from which it is recorded occur in regions of high summer rainfall, and the host fungus is most commonly encountered in the more humid parts of North America, such as the southeastern United States or the California coast, and in tropical Mexico.

The species is named in honor of Mr. Charles W. O'brien, whose collecting efforts have contributed greatly to my studies of the Ciidae.

Ceracis powelli NEW SPECIES
Fig. 23

Holotype.— ♂, ARIZONA: Rustler Park, 8 mi. W Portal, Cochise Co., Aug. 3, 1961, Lot 892 J. F. Lawrence, ex *Polyporus abietinus* on conifer [MCZ, No. 31286]. Allotype, ♀, same data [MCZ].

Male.—Length 1.47 mm. Body 2.36 × as long as broad. Head and prothorax dark reddish brown; elytra, pectus, and abdomen blackish; legs, antennal funicle, and palpi yellowish brown, antennal club dark brown. Vertex with a shallow, circular, median impression; frontoclypeal ridge weakly produced and emarginate, forming 2 rounded tubercles. Antennae 9-segmented; segment III 2 × as long as IV. Pronotum 0.86 × as long as broad, widest at posterior third; sides gradually converging anteriorly; anterior edge weakly produced and shallowly emarginate; surface distinctly granulate; punctures about 0.10 × as large as scutellar base and separated by 1.0 to 1.5 diameters. Elytra 1.60 × as long as broad and 2.10 × as long as pronotum; sides subparallel anteriorly, gradually converging posteriorly; punctation dual and confused, coarser and denser than pronotal punctation, the punctures usually separated by less than 1 diameter, becoming confluent anteriorly, so that the surface appears rugose. Metasternum 0.62 × as long as wide; suture absent. Abdomen 0.93 × as long as wide at base; sternite III with a circular, median, setigerous pore, which is 0.30 × as long as body of sternite, distinctly margined, and located posterad of center.

Female.—Length 1.22 mm. Body 2.33 × as long as broad. Vertex slightly convex; frontoclypeal ridge simple. Pronotum 0.94 ×

as long as broad; anterior edge rounded. Elytra 1.57 × as long as broad and 2.06 × as long as pronotum. Sternite III without a setigerous pore.

Variation.—Color of pronotum yellowish orange to black, usually either dark reddish brown to black or reddish; elytra yellowish to black, usually black with varying amounts of red posteriorly. All specimens from southern Arizona have a dark pronotum, whereas about two-thirds of the specimens from Durango have a reddish pronotum. Most individuals have a reddish fascia along the posterior part of the elytral suture, but in some specimens the entire apex is reddish. Pronotum in smaller males is indistinguishable from that of females, but in larger specimens the anterior edge is distinctly emarginate. Size and dimensions vary as follows in a series of 20 ♂♂ and 20 ♀♀ from 14 mi. SW El Salto, Durango, Mexico: TLmm: ♂ 1.22–1.55 (1.41± 0.021), ♀ 1.07–1.57 (1.36 ± 0.030); TL/EW ♂ 2.26–2.46 (2.35 ± 0.011), ♀ 2.21–2.45 (2.35 ± 0.013); PL/PW ♂ 0.85–0.95 (0.90 ± 0.007), ♀ 0.89–0.95 (0.92 ± 0.005); EL/EW ♂ 1.52–1.62 (1.57 ± 0.006), ♀ 1.46–1.64 (1.57 ± 0.009); EL PL ♂ 1.94–2.10 (2.02 ± 0.010), ♀ 1.94–2.11 (2.01 ± 0.010). Total size range in material examined: 1.07–1.57 mm.

Paratypes.—ARIZONA: 6, Rustler Park, 8 mi. W Portal, Cochise Co., Aug. 3, 1961, Lot 892 J. F. Lawrence, ex *Polyporus abietinus* on conifer [MCZ]; DURANGO: 9, 9 mi. E La Ciudad, July 23, 1964, Lot 1311 J. F. Lawrence (J. Powell, coll.), ex *Polyporus pargamenus* on *Quercus* sp. [MCZ]; 200, 14 mi. SW El Salto, June 20, 1964, E. E. Lindquist, coll., ex "*Polyporus*" on pine [CNC].

Distribution.—Southeastern Arizona and southern Durango (see Fig. 27). About 225 specimens examined from the following localities: **UNITED STATES**: ARIZONA: Miller Canyon (10 mi. W Hereford), Rustler Park (8 mi. W Portal); **MEXICO**: DURANGO: 9 mi. E La Ciudad, 14 mi. SW El Salto. [CNC, JFL, MCZ.]

Host fungi.—*Polyporus abietinus* [2(1)]; *Polyporus pargamenus* [1].

Discussion.—This is an elongate and narrow species with weakly developed pronotal and frontoclypeal characters in the male. It is superficially similar to *C. dixiensis*, from which it differs by having 9-segmented antennae, somewhat coarser pronotal punctation, and a smaller, circular abdominal pore. It also resembles smaller specimens of *C. californicus*, from which it may be distinguished by the somewhat finer and more confused elytral punctation, shorter 3rd antennal segment, and the shorter pronotum, which is narrowed anteriorly.

C. powelli is known only from intermediate and high elevations in the mountains of southern Arizona and northern Mexico (Huachuca Mts., Chiricahua Mts., and Sierra Madre Occidental), where it has been collected in association with *Polyporus abietinus* on pine and the related *P. pargamenus* on oak. In southern Arizona, the species is sympatric with both *C. dixiensis* and *C. californicus*, and the three may occur together in the canyons at middle elevations. The preference of *C. californicus* for species of *Ganoderma* and of *C. dixiensis* for *Trametes hispida* probably reduces competition among the three species.

This species is named for Dr. Jerry A. Powell who has collected a number of interesting Ciidae in western North America and Mexico.

Ceracis pullulus (Casey) NEW COMBINATION
Fig. 22

Ennearthron pullulum Casey, 1898: 90; Dury, 1917: 25; Blatchley, 1918: 54. Type locality: "Florida." Holotype, ♂, Casey Coll., USNM.

Plesiotypes.—♂ and ♀, FLORIDA: Highlands Hammock State Park, Highlands Co., June 24, 1965, Lot 1501 J. F. Lawrence, ex *Polyporus licnoides* [MCZ].

Male.— Length 1.47 mm. Body 2.56 × as long as broad. Head and prothorax dark

reddish brown; elytra blackish with a narrow reddish band along suture; ventral surfaces blackish; legs, antennal funicle, and palpi brownish yellow, antennal club dark brown. Vertex with a deep, transverse impression, preceded by a median elevation; frontoclypeal ridge produced, forming a short, broad, slightly concave lamina, which is shallowly emarginate at apex. Antennae 9-segmented; segment III 2 × as long as IV. Pronotum 1.09 × as long as broad, widest at middle; sides subparallel; anterior edge produced, forming a flat, slightly elevated lamina, which is deeply emarginate, giving the appearance of 2 slightly divergent, rounded horns; disc impressed anteriorly just behind lamina and bearing a short, transverse carina on each side of it; surface distinctly granulate; punctures about 0.09 × as large as scutellar base and separated by 1.0 to 2.0 diameters. Elytra 1.48 × as long as broad and 1.36 × as long as pronotum; sides subparallel for three-fourths of their lengths and abruptly converging near apices; punctation dual and distinctly seriate, the larger punctures forming relatively straight rows. Metasternum 0.52 × as long as wide; suture absent. Abdomen 0.85 × as long as wide at base; sternite III with a circular, median, setigerous pore, which is 0.33 × as long as body of sternite, indistinctly margined, and located posterad of center.

Female.—Length 1.42 mm. Body 2.48 × as long as broad. Vertex slightly convex; frontoclypeal ridge simple. Pronotum 1.00 × as long as broad; anterior edge rounded. Elytra 1.56 × as long as broad and 1.71 × as long as pronotum. Sternite III without a setigerous pore.

Variation.—Color of pronotum yellowish orange to black, usually dark reddish brown, often with the apex reddish; elytra yellowish to black, usually black with some reddish mesially along the suture. In smaller males, the pronotum is more rounded laterally and the anterior edge is weakly produced and emarginate, forming 2 approximate, subtriangular plates. In larger individuals the sides of the pronotum are subparallel and the apex is strongly and abruptly produced and deeply emarginate; the resulting horns are always broad and rounded at apices and may be subparallel or diverging. Surface of pronotum may be lightly or more distinctly granulate. Size and dimensions vary as follows in a series of 28 ♂ ♂ and 20 ♀ ♀ from Highlands Hammock State Park, Florida (Lot 1501): TLmm: ♂ 1.12–1.57 (1.38 ± 0.021), ♀ 1.07–1.52 (1.34 ± 0.025); TL/EW ♂ 2.23–2.58 (2.44 ± 0.014), ♀ 2.15–2.48 (2.28 ± 0.016); PL/PW ♂ 0.95–1.11 (1.05 ± 0.008), ♀ 0.87–1.00 (0.93 ± 0.006); EL/EW ♂ 1.36–1.50 (1.43 ± 0.008), ♀ 1.35–1.56 (1.44 ± 0.011); EL/PL ♂ 1.30–1.58 (1.42 ± 0.014), ♀ 1.64–1.85 (1.73 ± 0.012). Total size range in material examined: 1.03–1.62 mm.

Distribution.—Southern Coastal Plain and Gulf Coast of North America, from North Carolina south to Florida and west to Louisiana: Greater Antilles from Cuba to Puerto Rico (see Fig. 28). About 400 specimens examined from the following localities: **UNITED STATES**: ALABAMA: Mobile; FLORIDA: Chipola Park (Dead Lake), Enterprise, Haulover, Highlands Hammock State Park (6 mi. W Sebring), Key West, 2.5 mi. SE Lake City, 7 mi. SE Lake City, 4 mi. SE Lake Placid, 18 mi. SE Paradise Key, Pennekamp State Park (Key Largo); GEORGIA: Savannah; LOUISIANA: Audubon State Park, 4 mi. S Grosse Tete, 5 mi. S Livingston; NORTH CAROLINA: Magnolia, Randolph Co.; SOUTH CAROLINA: Moncks Corners, Yemassee; **WEST INDIES**: CUBA: Buenos Aires (Trinidad Mts.), Mina Carlotta (Trinidad Mts.), Soledad (Cienfuegos); JAMAICA: Kingston; PUERTO RICO: Cidra. [ANSP, BMNH, CAS, CIN, CNHM, JFC, MCZ, USNM.]

Host fungi.—*Polyporus gilvus* [7(3)]; *Polyporus licnoides* [4(4)]; *Ganoderma zonatum* [4(2)]; *Ganoderma* sp. [2(2)]; *Polyporus iodinus* [2(1)]; *Polyporus hydnoides* [1]; *Fomes igniarius* [1].

Discussion.—This species is similar in

size, form, and antennal segmentation to *C. thoracicornis* and *C. cucullatus*, but it is easily distinguished from both by the seriate elytral punctation. *C. singularis* also has the elytral punctures arranged in distinct rows, but it differs from *C. pullulus* in having 10-segmented antennae and distinctive pronotal horns in the male.

Assuming that the Philadelphia record for *C. curtus* is erroneous, *Ceracis pullulus* is the only West Indian species to extend along the Southern Coastal Plain as far as North Carolina. It is fairly common in central Florida, where it normally occurs on *Polyporus gilvus* and its relatives. In these fungi it may be associated with *Ceracis singularis*, *C. punctulatus*, and *Brachycis brevicollis* Casey.

In a series of about 100 specimens collected on *Ganoderma* sp. in Pennekamp State Park, Key Largo, Florida, no males could be found. It is possible that this represents a parthenogenetic population. Parthenogenesis is known in at least one other species of Ciidae, *Cis fuscipes* Mellié (Lawrence, 1967).

Ceracis punctulatus punctulatus Casey

Ceracis punctulata Casey, 1898: 90; Dury, 1917: 26; Blatchley, 1918: 54. Type locality: "Florida." Holotype, ♂, Casey Coll., USNM.

Plesiotypes.— ♂ and ♀, FLORIDA: 16 mi. W Miami, Dade Co., June 28, 1965, Lot 1528 J. F. Lawrence, ex *Polyporus hydnoides* on *Casuarina* sp. [MCZ].

Male.—Length 1.42 mm. Body 2.28 × as long as broad. Head and prothorax reddish brown; elytra, pectus, and abdomen brownish black; legs, antennal funicle, and palpi yellowish brown, antennal club dark brown. Vertex with deep, transverse impression, preceded by a median elevation; frontoclypeal ridge produced, forming a short, broad, slightly concave lamina, which is shallowly emarginate at apex. Antennae 8-segmented; segment III 2 × as long as IV. Pronotum 0.96 × as long as broad, widest at middle; sides weakly rounded; anterior edge produced, forming a flat, slightly elevated lamina, which is deeply emarginate, giving the appearance of 2 slightly diverging, subtriangular horns; disc impressed anteriorly just behind lamina and bearing a short, transverse carina on each side of it; surface lightly granulate; punctures about 0.11 × as large as scutellar base and separated by 0.5 to 1.0 diameter. Elytra 1.36 × as long as broad and 1.48 × as long as pronotum; sides subparallel for most of their lengths and abruptly converging near apices; punctation dual and confused, somewhat finer and sparser than pronotal punctation, the punctures often separated by 1 diameter posteriorly, becoming denser anteriorly. Metasternum 0.55 × as long as wide; suture barely indicated posteriorly. Abdomen 0.90 × as long as wide at base; sternite III with a circular, median, setigerous pore, which is 0.40 × as long as body of sternite, distinctly margined, and located posterad of center.

Female.—Length 1.37 mm. Body 2.29 × as long as broad. Vertex slightly convex; frontoclypeal ridge simple. Pronotum 0.95 × as long as broad, widest behind middle; anterior edge rounded. Elytra 1.42 × as long as broad and 1.62 × as long as pronotum. Sternite III without a setigerous pore.

Variation.—Color of pronotum yellowish orange to black, usually reddish brown or dark brown; elytra yellowish to black, usually dark brown or black, almost always unicolored, but occasionally reddish posteriorly near the suture and resembling *C. punctulatus rubriculus*. The most commonly observed form is that with the pronotum dark reddish brown and the elytra black. Anterior edge of pronotum in smaller males barely produced and emarginate, so that 2 tubercles are formed; in larger males the pronotum bears 2 distinct, subtriangular horns, which may be diverging. Size and dimensions vary as follows in a series of 25 ♂♂ and 25 ♀♀ from 16 mi. W Miami, Florida (Lot 1528): TLmm: ♂ 1.20–1.55 (1.38 ± 0.022), ♀ 1.05–1.52 (1.33 ± 0.022); TL/EW ♂ 2.13–2.38 (2.27 ± 0.014), ♀

2.07–2.30 (2.19 ± 0.013); PL PW ♂ 0.90–1.04 (0.95 ± 0.006), ♀ 0.86–0.96 (0.92 ± 0.006); EL EW ♂ 1.27–1.41 (1.35 ± 0.008), ♀ 1.30–1.45 (1.36 ± 0.009); EL PL ♂ 1.37–1.63 (1.48 ± 0.015), ♀ 1.55–1.76 (1.66 ± 0.013). Total size range in material examined: 1.05–1.65 mm.

Distribution.—Apparently restricted to Florida and intergrading with *rubriculus* in northern Florida and Georgia (see Fig. 34). About 200 specimens examined from the following localities: FLORIDA: Archbold Biological Station, Biscayne, Dunedin, Enterprise, Highlands Hammock State Park (6 mi. W Sebring), 13 mi. N Homestead, 7 mi. SE Lake City, 4 mi. SE Lake Placid, Miami, 16 mi. W Miami, Tampa. Probable intergrades seen from Chipola Park (Dead Lake), Calhoun Co., Florida, and Savannah, Georgia. [CIN, CNHM, CU, JFL, MCZ, UAL, USNM.]

Host fungi.—Polyporus hydnoides [5(4)]; *Polyporus licnoides* [2(2)]; *Ganoderma zonatum* [2(1)]; *Polyporus gilvus* [2]; *Ganoderma* sp. [1].

Discussion.—This species is very similar to *Ceracis sallei*, from which it may be distinguished by the somewhat coarser and denser pronotal punctation and the circular abdominal pore in the male. *C. schaefferi* is also similar in general appearance but differs by having much coarser and denser elytral punctation and finer and sparser pronotal punctation. The typical southern form is rare in collections and has often been confused with other species. A series of specimens from Massachusetts were determined as *C. punctulatus* and distributed to various museums by C. A. Frost; these specimens are all *C. minutissimus*.

Ceracis punctulatus is distributed throughout eastern North America, but the typical subspecies occurs only in central and southern Florida. It has been found breeding in *Polyporus hydnoides* and *Ganoderma zonatum*, where it was associated with *Ceracis sallei* and *C. multipunctatus*, and in *Polyporus licnoides*, along with *C. pullulus*. It is interesting that the southern race occurs with the related *C. sallei* in two different fungi, whereas the northern race, *rubriculus*, has never been collected with that species, although the two are sympatric over most of eastern North America.

A single dark specimen was collected at Chipola Park, Florida, along with 9 typical bicolored *rubriculus* on *P. gilvus*, and a few specimens in a series from Savannah, Georgia, have the red color on the elytra very much reduced. These probably represent intergrades. It is probable that *C. punctulatus punctulatus* represents a population isolated in central Florida during the Pleistocene inundation of the Southern Coastal Plain. Howden (1963) discusses the effects of these Pleistocene events on flightless Scarabaeidae. The black phenotype apparently originated in and spread through the island population, which, upon the reconnection of Florida with the mainland, spread northward and came into contact with the bicolored northern form. Further collecting in Georgia and northern Florida will be necessary to determine the extent to which the two forms are reproductively compatible.

Ceracis punctulatus rubriculus NEW SUBSPECIES
Fig. 13

Ceracis sallei Mellié (in part), Weiss, 1919: 144; Weiss and West, 1920: 8; Weiss and West, 1921: 169.

Ceracis sp., Gahan, 1927: 30; Graves, 1960: 66 (in part).

Holotype.— ♂, MISSOURI: 10 mi. S Columbia, Boone Co., Aug. 26, 1964, Lot 1348 J. F. Lawrence, ex *Polyporus gilvus* [MCZ, No. 31283]. Allotype, ♀, same data [MCZ].

Male.—Length 1.52 mm. Body 2.26 × as long as broad. Head and apex of pronotum reddish, remainder of pronotum dark reddish brown; elytra black anteriorly, posterior three-fifths reddish orange; prosternum and abdomen dark reddish brown, pectus black; legs, antennal funicle, and palpi brownish yellow, antennal club dark brown.

Vertex with a deep, transverse impression, preceded by a median elevation; frontoclypeal ridge produced, forming a short, broad, slightly concave lamina, which is shallowly emarginate at apex. Antenna 8-segmented; segment III 2 × as long as IV. Pronotum 0.93 × as long as broad, widest at middle; sides weakly rounded; anterior edge produced, forming a flat, slightly elevated lamina, which is deeply emarginate, giving the appearance of 2 subtriangular horns; disc impressed anteriorly just behind lamina and bearing a short, transverse carina on each side of it; surface lightly granulate; punctures about 0.12 × as large as scutellar base and separated by 0.5 to 1.0 diameter. Elytra 1.33 × as long as broad and 1.44 × as long as pronotum; sides subparallel for three-fourths of their lengths and abruptly converging near apices; punctation dual and confused, somewhat finer and sparser than pronotal punctation, the punctures often separated by 1 diameter posteriorly, becoming denser anteriorly. Metasternum 0.50 × as long as wide; suture barely indicated posteriorly. Abdomen 0.87 × as long as wide at base; sternite III with a circular, median, setigerous pore, which is 0.41 × as long as body of sternite, distinctly margined, and located posterad of center.

Female.—Length 1.50 mm. Body 2.14 × as long as broad. Vertex slightly convex; frontoclypeal ridge simple. Pronotum 0.88 × as long as broad, widest behind middle; anterior edge rounded. Elytra 1.36 × as long as broad and 1.73 × as long as pronotum. Sternite III without a setigerous pore.

Variation.—Color of pronotum yellowish orange to black, usualy dark reddish brown or black, often with the apex reddish; elytra yellowish to black, almost always black with a reddish orange, posteromesal patch, which varies in size but usually occupies less than two-thirds of the dorsal surface, occasionally reduced as in *C. punctulatus punctulatus.* Anterior edge of pronotum in smaller males barely produced and emarginate, so that 2 tubercles are formed; in larger males the pronotum bears 2 distinct, subtriangular horns, which may be subparallel or diverging. Size and dimensions vary as follows in a series of 36 ♂♂ and 35 ♀♀ from 10 mi. S Columbia, Missouri (Lot 1348): TLmm: ♂ 1.27–1.70 (1.44 ± 0.017), ♀ 1.25–1.55 (1.42 ± 0.012); TL/EW ♂ 2.11–2.31 (2.21 ± 0.010), ♀ 2.07–2.27 (2.17 ± 0.007); PL/PW ♂ 0.88–1.00 (0.94 ± 0.005), ♀ 0.84–0.96 (0.90 ± 0.005); EL/EW ♂ 1.23–1.39 (1.32 ± 0.006), ♀ 1.30–1.42 (1.37 ± 0.005); EL/PL ♂ 1.35–1.68 (1.49 ± 0.012), ♀ 1.56–1.89 (1.72 ± 0.012). Total size range in material examined: 1.20–1.75 mm.

Paratypes.—70, MISSOURI: same data as holotype [MCZ].

Distribution.—Eastern United States, from Michigan and southern Vermont to southern Texas and northern Florida, east of the 100th meridian; a single specimen recorded from western Cuba (see Fig. 34). About 800 specimens examined from the following localities: **UNITED STATES**: ALABAMA: Mobile, 10 mi. S Mobile, Selma; ARKANSAS: Hope, Washington Co.; DISTRICT OF COLUMBIA: Washington, Takoma Park; FLORIDA: Chipola Park (Dead Lake); GEORGIA: Savannah, Waycross; ILLINOIS: Carterville, Glen View, Plano, Springfield, Urbana, Willow Springs; INDIANA: Beverley Shores, Dune Areas (Porter Co.), Thayer; IOWA: Cedar Rapids; KANSAS: 5 mi. S Lawrence; KENTUCKY: near Cincinnati, Mammoth Cave National Park; LOUISIANA: Audubon State Park, 4 mi. S Grosse Tete, Harahan, 5 mi. S Livingston; MARYLAND: Beltsville, Bladensburg, Branchville, College Park, Great Falls, Jackson's Island, Plummer's Island, Sparrows Point; MASSACHUSETTS: Naushon Island; MICHIGAN: Ann Arbor, Lapeer State Game Area, Richfield Center; MISSISSIPPI: 15 mi. N Ackerman, Lucedale, 4 mi. W Starkville; MISSOURI: 3 mi. SW Arbor, 10 mi. S Columbia, St. Louis; NEW JERSEY: Anglesea, Arlington, Chester, Clementon, Middlebush, Midvale, Montclair, Springfield; NEW YORK: Fort Niagara, Ithaca, Mo-

sholu, New Rochelle, New York, Staten Island, West Point, Orient; NORTH CAROLINA: Beaufort, 1 mi. SW Brevard, Joyce Kilmer Forest, Magnolia, Raleigh, ¾ mi. SE Rocky Knob, Southern Pines, Tryon; OHIO: Cincinnati; PENNSYLVANIA: Chestnut Hill, Easton, Harrisburg, Mt. Moriah, Twin Lakes, Upper Darby, Wissahickon Cr.; SOUTH CAROLINA: Pawley's Beach; TENNESSEE: Bledsoe State Forest, Gatlinburg; TEXAS: Brownsville, Huntsville, Kerrville, San Antonio, Wallisville; VIRGINIA: Arlington, Clapham Junction, Falls Church, Occoquan; VERMONT: East Dorset; **WEST INDIES**: CUBA: Banos de San Vicente. [AMNH, ANSP, BMNH, CAS, CIN, CNC, CNHM, INHS, JFC, JFL, KU, MCZ, UAL, UCD, USNM.]

Host fungi.—Polyporus gilvus [32(13)]; *Polyporus hydnoides* [2]; *Ganoderma lucidum* [1]; *Ganoderma* sp. [1]; *Polyporus radiatus* [1]; *Fomes fomentarius* [1]; *Polyporus adustus* [1]; *Polyporus hirsutus* [1]; *Polyporus pargamenus* [1].

Discussion.—This subspecies differs from *C. punctulatus punctulatus* mainly in the color of the elytra, which are reddish orange posteriorly. *C. punctulatus rubriculus* has often been confused with *C. sallei* in collections and in the literature, because of the similarity of coloration between the two. *C. sallei* also has bicolored elytra, but the reddish color is usually more extensive, occupying two-thirds of the surface, and the pronotum is often more reddish. In addition, *C. sallei* has finer and sparser pronotal punctation and a transverse abdominal pore. A number of Weiss' records of *C. sallei* are based on specimens of *rubriculus*.

C. punctulatus rubriculus ranges over most of eastern North America and intergrades with *C. punctulatus punctulatus* in Georgia and northern Florida. It is more common in the southern part of the range and has not been collected in Canada or northern New England. The single specimen apparently found on *P. pargamenus* in Vermont may be a contaminant from a collection from Naushon Island, Massachusetts —the two were stored together for a time in Vermont. A specimen of *rubriculus* from western Cuba may represent a recent dispersal from southern Louisiana.

There is good evidence for a strong preference for *Polyporus gilvus*, since every other record above consists of a single adult specimen. This beetle is the most common and characteristic inhabitant of *P. gilvus* in eastern North America, and it may be found in association with *Ceracis singularis*, *C. pullulus*, *Brachycis brevicollis* Casey, and the tenebrionid beetle *Platydema ellipticum*. Throughout the same area, the closely related *C. sallei* occurs almost exclusively on *Ganoderma applanatum*. In Florida, however, there is less evidence of host preference in either species, and *C. sallei* has been collected on several occasions in the same fruiting body with *C. punctulatus punctulatus*. I think this suggests that host specificity played an important role in the evolution of *sallei* and *punctulatus* (the original monotypic species) from a common ancestor and that the situation in Florida represents a secondary breakdown of this mechanism. If the two ancestral populations had become geographically isolated long enough to produce a divergence in their genetic systems and then had reestablished contact, the evolution of a different food preference in each would greatly reduce the incidence of cross breeding and the accompanying disadvantages of hybrid inviability or hybrid sterility. When these patterns of host selection behavior had become fixed, the two species were free to spread throughout eastern North America and become completely sympatric but ecologically isolated. Both species spread into Florida, and then in the Pleistocene the Florida populations were isolated from the mainland. This isolation from the main gene pool, which was accompanied by a relatively rapid morphological change (decrease in size in *sallei*), may have also led to changes in food preference. If the two species were now reproductively in-

compatible, perhaps through differences in sexual behavior, then there would be no selective pressure against the development of similar food preferences. The genetics of island or founder populations is discussed at length in Mayr (1963).

The name *rubriculus* is derived from the Latin *ruber*, red, and the Latin *culus*, rump.

Ceracis quadricornis Gorham
Fig. 17

Ceracis quadricornis Gorham, 1886: 359. Type locality: "Mexico, Tuxtla." Holotype, ♂, BMNH.

Plesiotypes.— ♂ and ♀, TEXAS: Brownsville, H. S. Barber, coll., ex *Ganoderma pseudoboletus* [USNM].

Male.—Length 1.27 mm. Body 2.55 × as long as broad. Head and apex of pronotum reddish brown, remainder of pronotum blackish brown; elytra and ventral surfaces dark reddish brown; legs, antennal funicle, and palpi yellowish brown, antennal club dark brown. Vertex with a moderately deep, transverse impression, preceded by a median elevation; frontoclypeal ridge produced, forming a short, broad, slightly concave lamina, which is shallowly emarginate at apex. Antennae 8-segmented; segment III 2 × as long as IV. Pronotum 1.10 × as long as broad, widest at anterior third; sides gradually converging posteriorly; anterior edge produced and deeply emarginate, forming 2 divergent, slightly elevated horns, which are weakly carinate above and narrowly rounded at apices; disc slightly impressed just behind and between the horns and bearing a short, transverse carina laterad of each; surface distinctly granulate; punctures about 0.07 × as large as scutellar base and separated by 1.0 to 1.5 diameters. Elytra 1.53 × as long as broad and 1.32 × as long as pronotum; sides subparallel for most of their lengths, abruptly converging near apices; punctation dual and confused, coarser and denser than pronotal punctation, the punctures usually separated by less than 1 diameter. Metasternum 0.53 × as long as wide; suture barely indicated posteriorly. Abdomen 0.81 × as long as wide at base; sternite III with a circular, median, setigerous pore, which is 0.23 × as long as body of sternite, indistinctly margined, and located posterad of center.

Female.—Length 1.20 mm. Body 2.40 × as long as broad. Vertex somewhat flattened; frontoclypeal ridge simple. Pronotum 1.00 × as long as broad, widest behind middle; anterior edge rounded. Elytra 1.50 × as long as broad and 1.67 × as long as pronotum. Sternite III without a setigerous pore.

Variation.—Color of pronotum yellowish orange to black, usually dark reddish brown or blackish, with the apex reddish; elytra yellowish to black, usually dark reddish brown or black. Sides of pronotum in females and smaller males subparallel or slightly converging anteriorly; in larger males the sides diverging to apical third. Anterior edge of pronotum in smaller males bearing 2 approximate teeth; in larger males these are represented by 2 distinct horns, which may be flat or carinate and straight or slightly diverging. Size and dimensions vary as follows in a series of 14 ♂♂ and 14 ♀♀ from Brownsville, Texas: TLmm: ♂ 1.05–1.32 (1.17 ± 0.022), ♀ 0.97–1.20 (1.09 ± 0.019); TL/EW ♂ 2.44–2.67 (2.57 ± 0.021), ♀ 2.35–2.55 (2.43 ± 0.014); PL/PW ♂ 1.05–1.15 (1.09 ± 0.008), ♀ 0.93–1.00 (0.97 ± 0.008); EL/EW ♂ 1.44–1.55 (1.50 ± 0.008), ♀ 1.50–1.61 (1.55 ± 0.010); EL/PL ♂ 1.30–1.47 (1.40 ± 0.015), ♀ 1.67–1.86 (1.74 ± 0.014). Total size range in material examined: 0.96–1.35 mm.

Distribution.—Southern Texas, through eastern and southern Mexico and as far south as Costa Rica (see Fig. 30). About 275 specimens examined from the following localities: **UNITED STATES**: TEXAS: Brownsville; **MEXICO**: CHIAPAS: 24 mi. NW Huixtla, 9 mi. N Arriaga; OAXACA: 48 mi. E La Ventosa; PUEBLA: 29 mi. E Xilotepec; TAMAULIPAS: Tampico; VER-

ACRUZ: El Fortin, Tuxpango, San Juan de la Punta, Tierra Blanca, 9 mi. NE Panuco, Tejeria, Cordova, Veracruz, Tuxtla, Cotaxtla Experiment Station; **CENTRAL AMERICA**: COSTA RICA: 4 mi. N Canas, Turrialba; GUATEMALA: 4 mi. E Cuilapa, 6 mi. E Esquintla; NICARAGUA: 20 mi. SE Leon, 5 mi. N Esteli. [BMNH, CAS, CNHM, JFL, MCZ, USNM.]

Host fungi.—*Polyporus occidentalis* [5 (3)]; *Polyporus hirsutus* [2(1)]; *Polyporus maximus* [2(1)]; *Polyporus hydnoides* [2(1)]; *Trametes corrugata* [1(1)]; *Lenzites striata* [1(1)]; *Ganoderma* sp [1].

Discussion.—This is a very small, narrow, and elongate species with 2 narrow, diverging pronotal horns in the male. The general form and secondary sexual characters are similar to *C. thoracicornis* and *C. bicornis*, both of which have 9-segmented antennae. The elytral punctation is similar to that in *C. minutus*, but that species is shorter and broader in form. *C. dixiensis* and *C. minutissimus* differ by having coarser and denser elytral punctation and different pronotal modifications in the male.

Ceracis quadricornis is a tropical Mexican species which extends into the United States only as far as southern Texas. Although the Texas series was taken on an unknown *Ganoderma* ("pseudoboletus"), Mexican records indicate that the species prefers fungi in the *Polyporus versicolor* group, such as *P. occidentalis*, *P. hirsutus*, and *P. maximus*.

Ceracis sallei Mellié
Fig. 11

Enneanthron (*Ceracis*) *sallei* Mellié, 1848: 377, pl. 12, fig. 22; Casey, 1898: 90; Blatchley, 1910: 900; Dury, 1917: 26. Type locality: "Nouvelle-Orleans." Lectotype, ♂, Oberthur Coll. (Salle Coll.), MNHN.

Ceracis sp. (in part), Graves, 1960: 66.

Plesiotypes.—♂ and ♀, MASSACHUSETTS: Belmont, Middlesex Co., July 3, 1966, Lot 1816 J. F. Lawrence, ex *Ganoderma applanatum* [MCZ].

Male.—Length 1.72 mm. Body 2.38 × as long as broad. Head, maxillary palpi, and pronotum reddish brown; anterior third of elytra blackish brown, posterior two-thirds reddish yellow; ventral surfaces blackish; legs and antennal funicle brownish yellow, antennal club brownish. Vertex with a moderately deep, transverse impression, preceded by a median elevation; frontoclypeal ridge produced, forming a short, broad, slightly concave lamina, which is shallowly emarginate at apex. Antennae 8-segmented; segment III 2 × as long as IV. Pronotum 1.00 × as long as broad, widest at middle; sides subparallel; anterior edge produced, forming a flat, slightly elevated lamina, which is deeply emarginate, giving the appearance of 2 slightly divergent, subtriangular horns; disc impressed anteriorly just behind lamina and bearing a short, transverse carina in each side of it; surface distinctly granulate; punctures about 0.10 × as large as scutellar base and separated by 0.75 to 1.25 diameters. Elytra 1.38 × as long as broad and 1.38 × as long as pronotum; sides subparallel for three-fourths of their lengths and abruptly converging near apices; punctation dual and confused, about as coarse and dense as pronotal punctation, the punctures somewhat denser anteriorly. Metasternum 0.64 × as long as wide; suture about 0.18 × as long as median length of sternite. Abdomen 0.84 × as long as wide at base; sternite III with a transverse, median, setigerous pore, which is 0.83 × as long as wide, 0.45 × as long as body of sternite, indistinctly margined, and located posterad of center.

Female.—Length 1.52 mm. Body 2.18 × as long as broad. Vertex slightly convex; frontoclypeal ridge simple. Pronotum 0.96 × as long as broad; anterior edge rounded. Elytra 1.32 × as long as broad and 1.54 × as long as pronotum. Sternite III without a setigerous pore.

Variation.—Color of pronotum yellowish orange to blackish, usually either reddish or dark reddish brown; elytra yellowish to black, with the posterior portion reddish or reddish yellow. The pronotum is almost

always lighter in color than the posterior part. The reddish pigment on the elytra varies considerably, but it usually occupies more than half of the surface and often extends almost to the base mesially. Smaller males have the sides of the pronotum more rounded and the anterior edge barely emarginate, while larger specimens tend to have a parallel-sided pronotum with a distinct lamina anteriorly. The lamina varies in its width and in the depth and shape of the emargination, so that 2 small triangular teeth, 2 broad rounded horns, or 2 narrower diverging horns may be formed. In smaller individuals, the lamina may be less abrupt laterally and the transverse carinae may be absent. Size and dimensions vary as follows in a series of 25 ♂ ♂ and 25 ♀ ♀ from Belmont, Massachusetts (Lot 1816): TLmm: ♀ 1.25–1.72 (1.47 ± 0.029), ♀ 1.12–1.67 (1.42 ± 0.026); TL EW ♂ 2.08–2.39 (2.27 ± 0.017), ♀ 2.09–2.29 (2.20 ± 0.010); PL PW ♂ 0.87–1.00 (0.97 ± 0.007), ♀ 0.88–0.96 (0.93 ± 0.005); EL EW ♂ 1.25–1.43 (1.35 ± 0.008), ♀ 1.28–1.43 (1.36 ± 0.008); EL PL ♂ 1.37–1.65 (1.47 ± 0.016), ♀ 1.50–1.74 (1.62 ± 0.013). Total size range in material examined: 1.07–1.80 mm.

Distribution.—Eastern North America, from southern Ontario and Quebec to southern Texas and Florida, east of the 100th meridian (see Fig. 26). About 850 specimens examined from the following localities: **CANADA**: ONTARIO: Fonthill, Marmora, Toronto; QUEBEC: Lanoraie, Montreal, St. Jean; **UNITED STATES**: ALABAMA: Mobile; ARKANSAS: Hope; CONNECTICUT: New Haven; FLORIDA: Archbold Biological Station, Enterprise, Highlands Hammock State Park (6 mi. W Sebring), Jacksonville, 16 mi. W Miami; GEORGIA: Cornelia, Savannah, St. Simons Is., Waycross; ILLINOIS: Antioch, Carterville, Chicago, Des Plaines, Fort Sheridan, Fox, Frankfort, Glen Ellen, Glenview, Mound City, Oakwood, Steger, White Heath; INDIANA: Dune Acres, Dune Park, Posey Co.; IOWA: Cedar Rapids, Iowa City; KANSAS: Topeka; KENTUCKY: Mammoth Cave National Park; LOUISIANA: 4 mi. S Grosse Tete, New Orleans; MARYLAND: Berwyn; MASSACHUSETTS: Boston, Belmont, Concord, Naushon Island, Springfield, Tewksbury; MICHIGAN: Genessee Co., Lapeer and Irish Rds. (Lapeer Co.); MISSOURI: St. Louis, Willard; NEBRASKA: no specific locality; NEW JERSEY: Alpine, Hackensack; NEW YORK: Buffalo, De Bruce, Hempstead, Ithaca, New York, Pike; NORTH CAROLINA: Raleigh; OHIO: Cincinnati; OKLAHOMA: 2 mi. N Atoka; PENNSYLVANIA: Allegheny, Easton, Germantown, Glen Olden, Haverford, Jeanette, Mt. Airy, Pittsburgh, Tinicum Is., Twin Lakes, West View; TENNESSEE: no specific locality; TEXAS: Harris Co., Lee Co., San Antonio, San Diego, Welder Wildlife Refuge (near Sinton); VERMONT: East Dorset, Manchester, Peru; VIRGINIA: no specific locality; WEST VIRGINIA: Fairmont; WISCONSIN: Beaver Dam, Delavan. [AMNH, ANSP, CAS, CIN, CM, CNC, CNHM, CU, INHS, JFC, JFL, JS, KU, MCZ, MNHN, UAL, UCD, USNM, UW.]

Host fungi.—Ganoderma applanatum [20(11)]; *Ganoderma zonatum* [2(1)]; *Polyporus hydnoides* [2(1)]; *Ganoderma lucidum* [1]; *Fomes sclerodermeus* [1]; *Fomes pinicola* [1].

Discussion.—This is a moderately short and broad species with 8-segmented antennae, and it most nearly resembles *C. similis*, *C. schaefferi*, and *C. punctulatus*. It differs from the first two species by having finer and sparser elytral punctation and may be distinguished from *C. punctulatus* by its finer and sparser pronotal punctation and slightly transverse abdominal pore in the male. *C. castanipennis* is also somewhat similar to *sallei* but differs in the elytral punctation, which is single, coarse, and dense. Because of the similarity in color pattern, this species has often been confused with *C. punctulatus rubriculus*, with which it is broadly sympatric. Although there are some differences in the elytral coloration and the form of the pronotal

horns, only the pronotal punctation and the form of the abdominal pore can be used to consistently separate the two species.

The populations of *C. sallei* from parts of Florida consist of somewhat smaller individuals, but the differences are not great enough to warrant the recognition of a distinct subspecies.

Ceracis sallei is one of the more common species of this genus in eastern North America, and throughout most of its range it occurs on the fungus *Ganoderma applanatum*. In the northern parts of the continent, it is often associated with *Eridaulus levettei* (Casey) and the tenebrionid beetle *Bolitotherus cornutus* Panz. In the southern states it may occur with *Ceracis multipunctatus* and *C. punctulatus punctulatus*. The evolution of host specificity in *C. sallei* and *C. punctulatus* is discussed in the section on the latter species.

Ceracis schaefferi Dury
Fig. 14

Ceracis schaefferi Dury, 1917: 25. Type locality: "Brownsville, Texas." Holotype, ♂, Dury Coll., CIN.

Plesiotypes.— ♂ and ♀, TEXAS: Brownsville, H. S. Barber, coll., ex *Ganoderma pseudoboletus* [USNM].

Male.—Length 1.55 mm. Body 2.14 × as long as broad. Head and pronotum reddish; elytra reddish, grading into reddish brown anteriorly; ventral surfaces reddish brown; legs, antennal funicle, and palpi yellowish brown, antennal club brownish. Vertex with a moderately deep, transverse impression, preceded by a median elevation; frontoclypeal ridge produced, forming a short, broad, slightly concave lamina, which is shallowly emarginate at apex. Antennae 8-segmented; segment III 3 × as long as IV. Pronotum 0.93 × as long as broad, widest at middle; sides subparallel; anterior edge weakly produced, forming a very short and broad, elevated, subtrapezoidal lamina, which is shallowly emarginate at apex; disc impressed anteriorly just behind lamina; surface distinctly granulate; punctures about 0.12 × as large as scutellar base and separated by 0.75 to 1.50 diameters. Elytra 1.24 × as long as broad and 1.30 × as long as pronotum; sides subparallel for three-fourths of their lengths and abruptly converging near apices; punctation dual and confused, coarser and much denser than pronotal punctation, the punctures usually separated by less than 0.50 diameter. Metasternum 0.59 × as long as wide; suture absent. Abdomen 0.76 × as long as wide at base; sternite III with a circular, median, setigerous pore, which is 0.35 × as long as body of sternite, distinctly margined, and located posterad of center.

Female.—Length 1.55 mm. Body 2.21 × as long as broad. Vertex somewhat flattened; frontoclypeal ridge simple. Pronotum 0.93 × as long as broad; anterior edge rounded. Elytra 1.22 × as long as broad and 1.48 × as long as pronotum. Sternite III without a setigerous pore.

Variation.—Color of pronotum yellowish orange to blackish, usually reddish and often suffused with varying amount of black or brownish; elytra yellowish to blackish, usually reddish posteriorly and blackish anteriorly. Sides of pronotum more rounded in females and small males; in larger males distinctly parallel-sided. Pronotal lamina varies according to size, but it is always short, broad, and distinctly elevated. Size and dimensions vary as follows in a series of 14 ♂♂ and 14 ♀♀ from Brownsville, Texas: TLmm: ♂ 1.25–1.55 (1.45 ± 0.023), ♀ 1.20–1.57 (1.44 ± 0.023); TL EW ♂ 2.12–2.26 (2.17 ± 0.011), ♀ 2.09–2.25 (2.16 ± 0.010); PL PW ♂ 0.88–0.96 (0.92 ± 0.007), ♀ 0.90–0.96 (0.93 ± 0.005); EL EW ♂ 1.24–1.33 (1.28 ± 0.007), ♀ 1.26–1.36 (1.30 ± 0.007); EL PL ♂ 1.35–1.55 (1.45 ± 0.015), ♀ 1.42–1.56 (1.50 ± 0.010). Total size range in material examined: 1.15–1.65 mm.

Distribution.—Southern Texas and eastern Mexico (see Fig. 28). About 150 specimens examined from the following localities: **UNITED STATES**: TEXAS: Brownsville, Columbus; **MEXICO**: NUEVO LEON: 5 mi. S Monterrey; TAMAULIPAS: Tam-

pico; VERACRUZ: 3 mi. N Fortin. [CAS, CNC, JFL, MCZ, USNM.]

Host fungi.—*Ganoderma* sp. [1].

Discussion.—This is a short and broad, reddish species in which the elytral punctation is much coarser and denser than that of the pronotum. It resembles *C. sallei*, with which it is sympatric in southern Texas, but it is easily distinguished from that species by the elytral punctation and the short pronotal lamina in the male. It appears to be most closely related to *Ceracis similis*, but the latter is somewhat more elongate, with a more prominent pronotal lamina in the male.

Ceracis schaefferi is another tropical Mexican species, extending from southeastern Mexico into southern Texas. The only known host is an unidentified species of *Ganoderma*. The closely related *C. similis* occurs in western Mexico and Baja California and has been collected on species of *Ganoderma*; further collecting in Mexico may reveal that *C. schaefferi* is an eastern race of *similis*.

Ceracis singularis (Dury) NEW COMBINATION
Fig. 12

Xesto singularis Dury, 1917: 14. Type locality: "Cincinnati, Ohio." Types, Dury Coll., CIN.
Ceracis sp. (in part), Graves, 1960: 66.

Plesiotypes.— ♂ and ♀, NORTH CAROLINA: 1 mi. SW Brevard, Transylvania Co., June 21, 1962. No. 150 R. C. Graves, ex *Polyporus gilvus* [MCZ].

Male.—Length 1.60 mm. Body 2.29 × as long as broad. Head and apex of pronotum reddish, remainder of pronotum dark reddish brown; elytra, prosternum, and abdomen reddish, pectus dark reddish brown; legs, antennal funicle, and palpi brownish yellow, antennal club dark brown. Vertex with a transverse impression, in the center of which is a deep, circular fovea; frontoclypeal ridge produced, forming a short, broad, slightly concave lamina, which is shallowly emarginate at apex. Antennae 10-segmented; segment III 1.25 × as long as IV. Pronotum 0.96 × as long as broad, widest behind middle; sides broadly rounded; anterior edge produced, forming a lamina which is deeply emarginate apically and bears a short, longitudinal elevation on each side, giving the appearance of 2 rounded, slightly divergent horns, each bearing a dorsal knob; disc impressed anteriorly between the 2 knobs; surface distinctly granulate; punctures about 0.10 × as large as scutellar base and separated by 1.0 to 2.0 diameters. Elytra 1.39 × as long as broad and 1.56 × as long as pronotum; sides subparallel for half of their lengths and gradually converging apically; punctation dual and distinctly seriate, the large punctures forming relatively straight rows; interstices convex, giving the appearance of several raised, longitudinal ridges. Metasternum 0.54 × as long as wide; suture barely indicated posteriorly. Abdomen 0.87 × as long as wide at base; sternite III with a transverse, median, setigerous pore, which is 0.71 × as long as wide, 0.23 × as long as body of sternite, indistinctly margined, and located posterad of center.

Female.—Length 1.52 mm. Body 2.18 × as long as broad. Vertex slightly convex; frontoclypeal ridge simple. Pronotum 0.92 × as long as broad, widest at posterior fifth; sides gradually converging apically; anterior edge rounded. Elytra 1.39 × as long as broad and 1.62 × as long as pronotum. Sternite III without a setigerous pore.

Variation.—Color of pronotum yellowish orange to black, usually reddish or dark reddish brown with the apex reddish; elytra yellowish to black, usually reddish or dark reddish brown, commonly lighter in color than pronotum, occasionally with basal third blackish and apical two-thirds reddish. In smaller males, the anterior edge of the pronotum is weakly produced and shallowly emarginate, and the knobs are barely developed as short carinae. In larger specimens the horns are well developed and distinctly divergent and the knobs project well above the plane of the lamina. Pro-

notal punctation varies and may be somewhat coarser and denser than that described for the plesiotype. Size and dimensions vary as follows in a mixed series of 14 ♂♂ and 14 ♀♀ from North Carolina: TLmm: ♂ 1.45–1.82 (1.68 ± 0.037), ♀ 1.42–1.70 (1.57 ± 0.022); TL EW ♂ 2.21–2.45 (2.33 ± 0.020), ♀ 2.14–2.33 (2.24 ± 0.016); PL PW ♂ 0.93–1.04 (0.99 ± 0.009), ♀ 0.89–1.00 (0.94 ± 0.008); EL EW ♂ 1.34–1.47 (1.39 ± 0.011), ♀ 1.31–1.44 (1.38 ± 0.009); EL PL ♂ 1.36–1.58 (1.48 ± 0.021), ♀ 1.52–1.68 (1.61 ± 0.010). Total size range in material examined: 1.30–2.00 mm.

Distribution.—Eastern North America, from northern Minnesota and Massachusetts to southeastern Texas and Louisiana, east of the 100th meridian; a single isolated record from Costa Rica (see Fig. 33). About 280 specimens have been examined from the following localities: **CANADA**: ONTARIO: Leamington; **UNITED STATES**: ALABAMA: Selma; ARKANSAS: southwest; DISTRICT OF COLUMBIA: Washington; ILLINOIS: Antioch, Des Plaines, Fox, Galesburg, Glen View, Normal, Pt. Chester, Quincy, White Heath; INDIANA: Evansville; KENTUCKY: Mammoth Cave National Park; LOUISIANA: Audubon State Park; MARYLAND: Edgewood, Plummer's Island; MASSACHUSETTS: Cummington, Naushon Island, Woods Hole; MICHIGAN: Detroit; MINNESOTA: 10 mi. E Detroit Lakes; MISSISSIPPI: 15 mi. N Ackerman; NEBRASKA: Central City; NEW YORK: Ithaca, St. Hubert's; NORTH CAROLINA: 1 mi. SW Brevard, 6 mi. SE Cashiers, Joyce Kilmer Forest, 1¼ mi. SE Lake Toxaway, Magnolia, Moore Co., 1 mi. S Oakland, Raleigh, Randolf Co., ¾ mi. SE Rocky Knob, Sampson City; OHIO: Cincinnati; OKLAHOMA: 2 mi. N Atoka; PENNSYLVANIA: Chestnut Hill, Wissahickon Cr.; SOUTH CAROLINA: Florence, Moncks Corners, Santee State Park, Yemassee; TENNESSEE: Cumberland Gap, Bledsoe State Forest; TEXAS: Huntsville; VIRGINIA: Clapham Junction; **CENTRAL AMERICA**: COSTA RICA: Irazu, 1500′. [AMNH, BMNH, CNC, CNHM, CU, INHS, JFC, JFL, MCZ, USNM.]

Host fungi.—Polyporus gilvus [12(4)]; *Ganoderma applanatum* [3(1)]; *Fomes robiniae* [2(1)]; *Poria nigra* [1(1)]; *Lenzites saepiaria* [1(1)]; *Ganoderma curtisii* [1]; *Fomes conchatus* [1]; *Fomes igniarius* [1]; *Trametes hispida* [1]; *Polyporus versicolor* [1]; *Polyporus pargamenus* [1].

Discussion.—This is easily distinguished from all other species of *Ceracis* by the 10-segmented antennae, distinctly seriate elytral punctation, and the very peculiar pronotal horns in the male. Each horn bears a distinct protuberance above, which is evident even in smaller males. The only species with similar horns is *C. furcicollis* (Blair) from Polynesia; although the antennae of *furcicollis* are 10-segmented, the elytral punctation is not seriate. Seriate elytral punctation also occurs in *C. pullulus*, but that species has 9-segmented antennae and different pronotal modifications.

Ceracis singularis has a rather peculiar distribution. It occurs throughout the eastern United States, being more common in the Midwest, and has also been collected on Mt. Irazu in Costa Rica. Its absence in Mexico may be an artifact of collecting, but it is also possible that the Costa Rican population is a southern relict. Host records indicate a strong preference for *Polyporus gilvus* and related fungi with reddish brown fruiting bodies. It is one of the few North American ciids to breed in the woody fruiting bodies of *Fomes robiniae*.

Ceracis thoracicornis (Ziegler) NEW COMBINATION

Fig. 21

Cis thoracicornis Ziegler, 1845: 270. Type locality: "Carolina." Types?, LeConte Coll., MCZ.

Enneartbron thoracicorne, — LeConte, 1867: 58; Casey, 1898: 88; Blatchley, 1910: 900; Dury, 1917: 23, 24; Weiss and West, 1920: 8; Weiss and West, 1921: 169; Böving and Craighead, 1931: 270–271, pl. 92, fig. R (larva).

Enneartbron mellyi Mellié, 1848: 369; Casey,

1898: 88 (syn.). Type locality: "Amerique boreale." Holotype, ♂, Melly Coll., GEN.

Cis pumicatus Mellié, 1848: 333, pl. 11, fig. 11. Type locality: "Nouvelle-Orleans." Holotype, ♀, Pic Coll. (Chevrolat Coll.), MNHN. NEW SYNONYMY.

Octotemnus ? pumicatus (Mellié), Casey, 1898: 91.

Ennearthron unicolor Casey, 1884: 37; Casey, 1898: 88 (syn.). Type locality: "Willet's Point, Long Island" [New York]. Holotype, ♂, Casey Coll., USNM.

Ennearthron laminifrons Casey, 1898: 89; Dury, 1917: 24. Type locality: "Louisiana (Morgan City)." Holotype, ♂, Casey Coll., USNM. NEW SYNONYMY.

Ennearthron piceum Casey, 1898: 88; Dury, 1917: 24. Type locality: "Texas (Columbus)." Holotype, ♂, Casey Coll., USNM. NEW SYNONYMY.

Ennearthron oblongus Blatchley, 1910: 900; Dury, 1917: 24; Weiss and West, 1920: 8. Type locality: "Marion Co." [Indiana]. Types, Blatchley Coll., PURD. NEW SYNONYMY.

Cis thoracicus Dalla Torre, 1911: 19. Incorrect subsequent spelling.

Ceracis bifoveatus Dury, 1917: 26. Type locality: "Cincinnati, Ohio." Holotype, ♂, Dury Coll., CIN. NEW SYNONYMY.

Cis thoracicinus Sherborn, 1931: 6493. Incorrect subsequent spelling.

Plesiotypes.— ♂ and ♀, VERMONT: East Dorset, Bennington Co., July 2, 1965, Lot 1768 J. F. Lawrence (C. Parsons, coll.), ex *Polyporus pargamenus* [MCZ].

Male.—Length 1.55 mm. Body 2.38 × as long as broad. Head and apex of pronotum reddish brown; remainder of pronotum, ventral surfaces, and greater portion of elytra black, a median elytral fascia, extending along the suture and widening apically, reddish; legs, antennal funicle, and palpi yellowish brown, antennal club dark brown. Vertex with a deep, transverse impression, preceded by a median elevation; frontoclypeal ridge produced, forming a relatively long, slightly concave, elevated, trapezoidal lamina, which is shallowly emarginate at apex. Antennae 9-segmented; segment III 1.67 × as long as IV. Pronotum 1.04 × as long as broad, widest at middle; sides subparallel; anterior edge strongly produced and deeply emarginate, forming 2 approximate, diverging horns, which are circular in cross-section and narrowly rounded at apices; disc impressed anteriorly just behind the horns and bearing a short, transverse carina laterad of each; surface distinctly granulate; punctures about 0.14 × as large as scutellar base and separated by 1.0 to 1.5 diameters. Elytra 1.38 × as long as broad and 1.38 × as long as pronotum; sides very weakly rounded, diverging to about middle and converging posteriorly; punctation dual and confused, finer and sparser than pronotal punctation posteriorly, becoming coarser and denser anteriorly. Metasternum 0.52 × as long as wide; suture barely indicated posteriorly. Abdomen 0.86 × as long as wide at base; sternite III with a circular, median, setigerous pore, which is 0.30 × as long as body of sternite, indistinctly margined, and located posterad of center.

Female.—Length 1.40 mm. Body 2.33 × as long as broad. Vertex slightly convex; frontoclypeal ridge simple. Pronotum 0.95 × as long as broad; anterior edge rounded. Elytra 1.50 × as long as broad and 1.80 × as long as pronotum. Sternite III without a setigerous pore.

Variation.—Color of pronotum yellowish orange to black, usually dark reddish brown or blackish, with apex commonly reddish brown; elytra yellowish to black, usually dark reddish brown or black and almost always with some reddish pigment along the suture posteriorly. Surface of pronotum very lightly to distinctly granulate, so that it may appear shiny or dull. Pronotal punctures vary somewhat in size and density. Frontoclypeal ridge in smaller males short and broad; elongate and trapezoidal in larger specimens. Pronotum usually narrower and more rounded in smaller males and the anterior edge only slightly produced, forming 2 small tubercles; in larger individuals the pronotum is broader and more parallel-sided and the anterior edge bears 2 long diverging horns. Size and dimensions vary as follows in a series of 14 ♂♂ and 14 ♀♀ from Bennington Co., Vermont (Lots 1719, 1730, and 1768): TLmm.: ♂ 1.10–1.55 (1.40 ± 0.033), ♀ 1.10–1.45 (1.33 ± 0.025);

TL EW ♂ 2.26–2.50 (2.38 ± 0.020), ♀ 2.22–2.37 (2.29 ± 0.011); PL PW ♂ 0.94–1.09 (1.02 ± 0.013), ♀ 0.91–1.00 (0.94 ± 0.006); EL EW ♂ 1.36–1.50 (1.42 ± 0.012), ♀ 1.39–1.54 (1.46 ± 0.010); EL PL ♂ 1.38–1.60 (1.49 ± 0.017), ♀ 1.67–1.90 (1.76 ± 0.017). Total size range in material examined: 1.00–1.67 mm.

Distribution.—Eastern North America, from southeastern Manitoba and southern Quebec to southern Texas and Florida, east of the 100th meridian (see Fig. 31). About 1300 specimens examined from the following localities: **CANADA**: MANITOBA: Aweme, Falcon Lake, Victoria Beach; ONTARIO: Leamington, St. Thomas, Toronto; QUEBEC: Montmorency Co., Montreal Is., Terrebonne Co.; **UNITED STATES**: ALABAMA: 6 mi. SE Eutaw, Mobile; ARKANSAS: Washington Co.; CONNECTICUT: New Haven, Stamford; DISTRICT OF COLUMBIA: Takoma Park, Washington; FLORIDA: Chipola Park (Dead Lake), 4 mi. NW Copeland, Dunedin, Enterprise, Highlands Hammock State Park (6 mi. W Sebring), Kissimmee, Lake Annie, 2.5 mi. SE Lake City, Palatka, St. Petersburg; GEORGIA: Valdosta, 12 mi. SSE Valdosta; ILLINOIS: Exeter, Fort Sheridan, Fox, Karnak, Oakwood, Olive Branch, St. Clair Co., Springfield, Steger, Urbana, West Pullman, White Heath, Willow Springs; INDIANA: Beverly Shores, Dune Acres, Marion Co., Mt. Vernon, Shelby; IOWA: Ames, Cedar Rapids, Estherville, Gutenburg; KANSAS: Benedict, Lawrence, Onaga, Topeka, Winfield; KENTUCKY: Mammoth Cave National Park; LOUISIANA: Audubon State Park, Baton Rouge, Fontainebleau State Park, Harahan, Killian, Lewiston, 5 mi. S Livingston, Morgan City, New Orleans, Norco, 11 mi. W Port Allen, Tallulah; MAINE: Monmouth, Paris, Weld; MARYLAND: Baltimore, College Park, 2 mi. E Silver Springs, Sparrows Point; MASSACHUSETTS: Arlington Heights, Belmont, Boston, Cambridge, Concord, Dracut, Framingham, Petersham, 2 mi. S Plymouth, Naushon Is., 10 mi. SE North Adams, Sherborn, Stoneham, Swansea; MICHIGAN: Detroit, Douglas Lake, Lansing, Lapeer State Game Area, Richfield Center, Whitmore Lake, 15 mi. SE Saugatuck; MINNESOTA: Cormorant, Lake Minnetonka, Mille Lacs Lake, Olmstead Co., Winnebago Creek Valley; MISSISSIPPI: 15 mi. N Ackerman, Little Mountain Park, N. Augusta, 4 mi. W Starkville; MISSOURI: Kansas City; NEBRASKA: Central City; NEW HAMPSHIRE: Farmington, Squam Lake, 7 mi. NW Wilton; NEW JERSEY: Atlantic Co., Mercer Co., Middlebush, Middlesex Co., Monmouth Junction, Oakland, Springfield, Fort Lee; NEW YORK: Albany, Flushing (Long Island), Hamburg, Ithaca, Lancaster, New York, Niagara, N. Fairhaven, Olcott, St. Hubert's, Staten Island, West Point; NORTH CAROLINA: 1 mi. SW Brevard, Calypso, 6 mi. SE Cashiers, 3 mi. W Highlands, 4 mi. W Highlands, Magnolia, Moore Co., 1 mi. S Oakland, 1 mi. E Oakland, 3 mi. SSW Oakland, 4 mi. SSW Oakland, 4 mi. S Oakland, Raleigh; OHIO: Cincinnati, Columbiana, E. Liverpool; PENNSYLVANIA: Allegheny, Chestnut Hill, Clinton, Easton, Jeannette, Philadelphia, Pittsburgh, Twin Lakes, Wissahickon Creek; RHODE ISLAND: Berkeley; SOUTH CAROLINA: Moncks Corners, Santee State Park, Walterboro, Yemassee; TENNESSEE: Memphis; TEXAS: Brownsville, Columbia, Columbus, Dennison, Nachadoches, Victoria; VERMONT: East Dorset, Manchester, Peru; VIRGINIA: Chain Bridge, Clapham Junction, Falls Church, Fredericksburg, Vienna; WISCONSIN: Beaver Dam, Powers Lake. [AMNH, ANSP, CAS, CIN, CM, CNC, CNHM, CU, IHI, INHS, JFC, JFL, JS, KU, MCZ, MNHN, PURD, UAL, UAZ, UCD, USNM.] A series of specimens apparently collected in San Luis Obispo Co., California, have almost certainly been mislabeled.

Host fungi.—*Polyporus pargamenus* [31 (10)]; *Polyporus adustus* [11(4)]; *Polyporus supinus* [9(5)]; *Polyporus versicolor* [9(1)];

Lenzites betulina [8(2)]; *Polyporus sector* [5 (1)]; *Daedalea ambigua* [4(2)]; *Daedalea unicolor* [4(2)]; *Polyporus gilvus* [4]; *Ganoderma lucidum* [3(1)]; *Ganoderma applanatum* [3]; *Ganoderma tsugae* [3]; *Trametes corrugata* [2(1)]; *Polyporus abietinus* [1 (1)]; *Polyporus spraguei* [1(1)]; *Trametes hispida* [1(1)]; *Ganoderma* sp. [1(1)]; *Polyporus squamosus* [1]; *Polyporus hydnoides* [1]; *Polyporus fumosus* [1]; *Polyporus sulphureus* [1]; *Fomes fomentarius* [1]; *Fomes pinicola* [1]; *Boletus* sp. [1].

Discussion.—This is a moderately small, dark colored species with relatively fine and sparse punctation, 9-segmented antennae, and 2 narrow, diverging pronotal horns in the male. It is probably most closely related to the Neotropical species *C. cucullatus* and *C. bicornis*, from which it differs by the somewhat coarser pronotal punctation and different pronotal modifications. It is similar in size and form to *C. pullulus*, which has seriate elytral punctation and a rounded, emarginate pronotal lamina in the male. Smaller specimens resemble *C. minutus* and *C. minutissimus*, both of which have 8-segmented antennae. *C. quadricornis* has similar coloration and pronotal horns, but the antennae are 8-segmented and the elytra are much narrower. The species also resembles the western *C. californicus*, which is somewhat more elongate and has much coarser and denser elytral punctation.

Like *C. californicus*, this species is quite variable, not only in size, but in the form of pronotum and elytra, pronotal horns in the male, and pronotal punctation. As a result several names have been applied to it. The more typical eastern form was described as *Cis thoracicornis* by Ziegler (1845), *Ennearthron mellyi* by Mellié (1848), and *Ennearthron unicolor* by Casey (1898). Mellié also gave the name *Cis pumicatus* to a single female from New Orleans. Casey (1898) considered *unicolor* and *mellyi* to be synonymous with *thoracicornis*, and he described two more species, *Ennearthron piceum* and *E. laminifrons*. *E. piceum* from Texas and Louisiana was described as having the prothorax impressed behind the horns, and *E. laminifrons* from Louisiana was distinguished by having shorter elytra. Blatchley (1910) described *Ennearthron oblongus* from Indiana, which was said to differ from *thoracicornis* by having coarser pronotal punctation. Finally, Dury (1917) proposed the name *Ceracis bifoveatus* for a series from Cincinnati with 8-segmented antennae and peculiar modifications of the 3rd abdominal sternite in the male. The types of all of these species have been examined, and they are all considered to be variants of *C. thoracicornis*. The segments were miscounted in *C. bifoveatus*, and the slight depression in front of the male abdominal pore also occurs in some *thoracicornis*. Some of the above species names refer to geographic variants, but I do not think that there are any clearly recognizable subspecies. Northern populations seem to have coarser pronotal punctation than those in the south, and in southern populations the size may be smaller and the pronotal horns longer. The color pattern is relatively consistent throughout the range, and in mature adults it may be useful as a diagnostic character. The elytra are usually blackish, as is the pronotum, but there is usually a narrow reddish patch along the posterior part of the elytral suture.

Ceracis thoracicornis is the most common, widespread, and polyphagous species in eastern North America. It is fairly common in the northern states, and it extends into the southern parts of Manitoba, Ontario, and Quebec. It has been collected on 24 different species of fungi and apparently breeds in at least 14 of these. Its preferred host appears to be *Polyporus pargamenus*, with 31 records and 10 of these breeding records, but it is also quite common on *P. adustus*, *P. supinus*, and members of the *Polyporus versicolor* group. In the northern part of its range it occurs with *Cis confusus* Blatchley, *Cis horridulus* Casey, and *Cis striolatus* Casey on *P. pargamenus*, and with *Cis fuscipes* Mellié, *Cis pistoria* Casey, *Sulcacis lengi* Dury, *Strigocis opacicollis* Dury,

and *Octotemnus laevis* Casey on *P. versicolor* and its relatives. All of these associated species are northern Holarctic forms with relatives in Europe and Asia, while *C. thoracicornis* and all other known North American *Ceracis* have affinities with Neotropical species. In the southern part of the range, the species has more of a tendency to be polyphagous, and is fairly common on *Polyporus supinus*, *P. sector*, and *Daedalea ambigua*.

This species, like *C. californicus*, breeds in fungi falling into both of Paviour-Smith's host preference groups, *P. adustus* and *Ganoderma lucidum* (among others) belonging to one group and *P. versicolor*, *Lenzites betulina* and several others belonging to the second group. My own records for North American ciids indicate that *P. pargamenus*, *P. sector*, and *P. abietinus* form a third group, for which *C. thoracicornis* is both an indicator and an exception. The absence of any close relatives in North America may partly explain the broad host range of this species.

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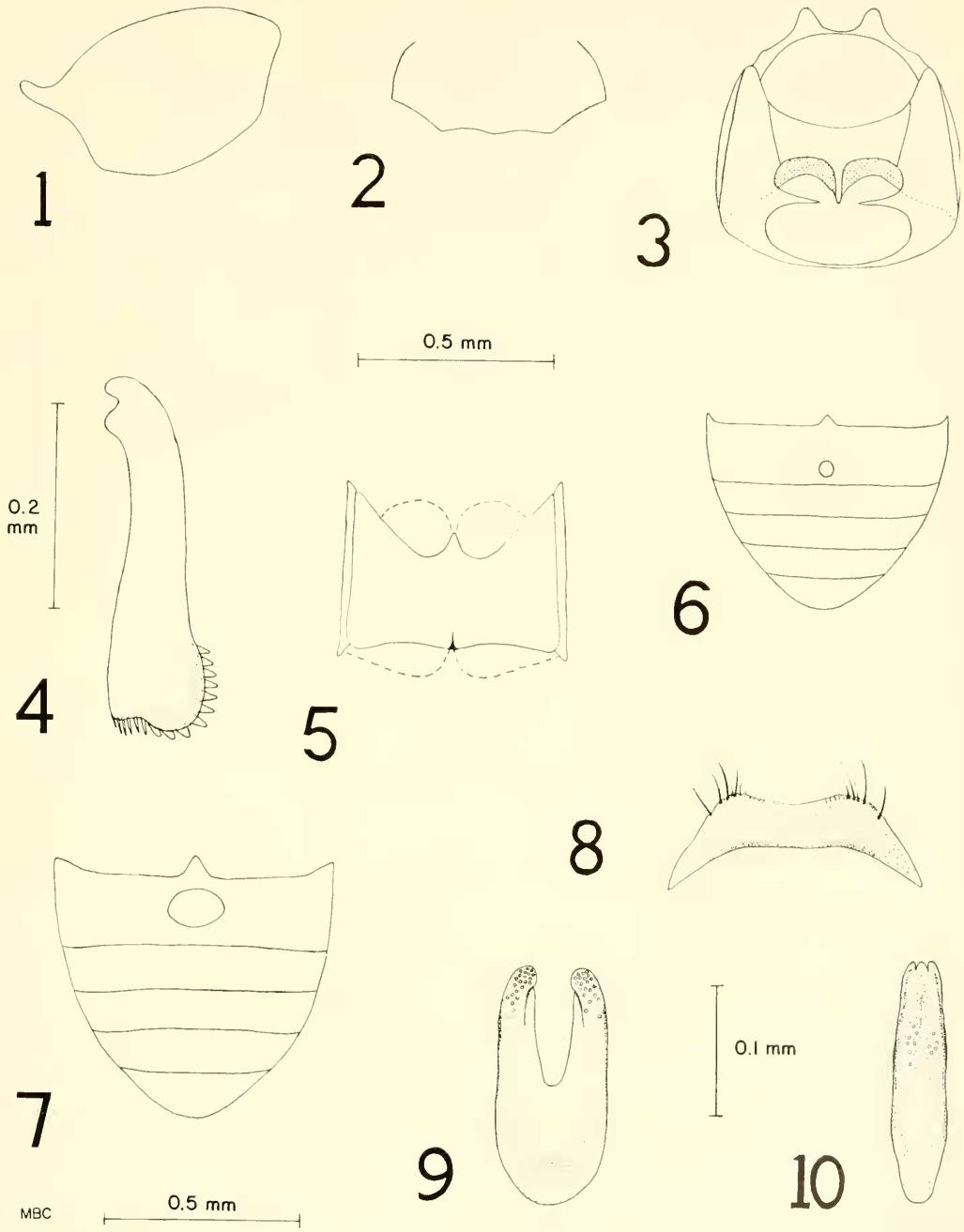
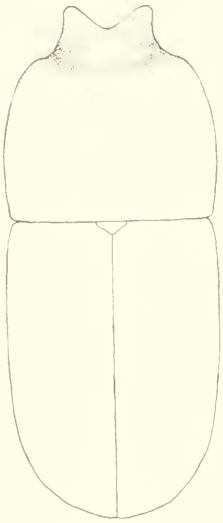


Figures 1–5. *Ceracis sallei* Mellié. Fig. 1. Pronotal disc, lateral view. Fig. 2. Cross-section of prosternum (anterad of intercoxal process). Fig. 3. Prothorax, ventral view. Fig. 4. Protibia, anterior view. Fig. 5. Metasternum, showing very short median suture. Fig. 6. *Ceracis punctulatus rubriculus*, n. ssp., male, abdomen, ventral view, showing small round setigerous pore. Fig. 7. *Ceracis obrieni*, n. sp., male, obdomen, ventdal view, showing lorge, transverse setigerous pore. Figures 8–10. *Ceracis sallei* Mellié, male. Fig. 8. Abdominal sternite VIII. Fig. 9. Tegmen, ventrol view. Fig. 10. Median lobe, dorsol view.



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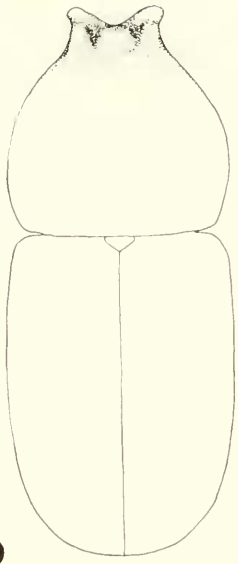

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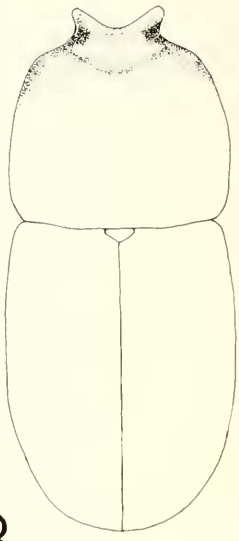

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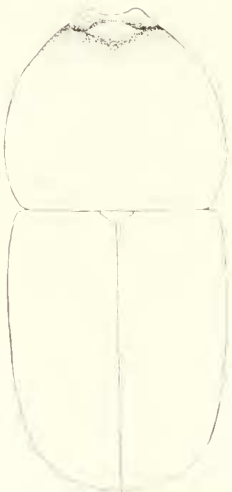

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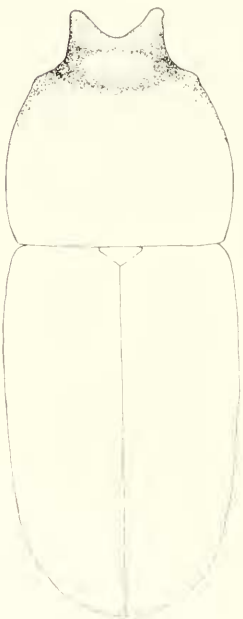

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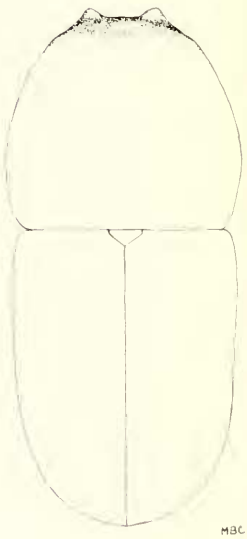

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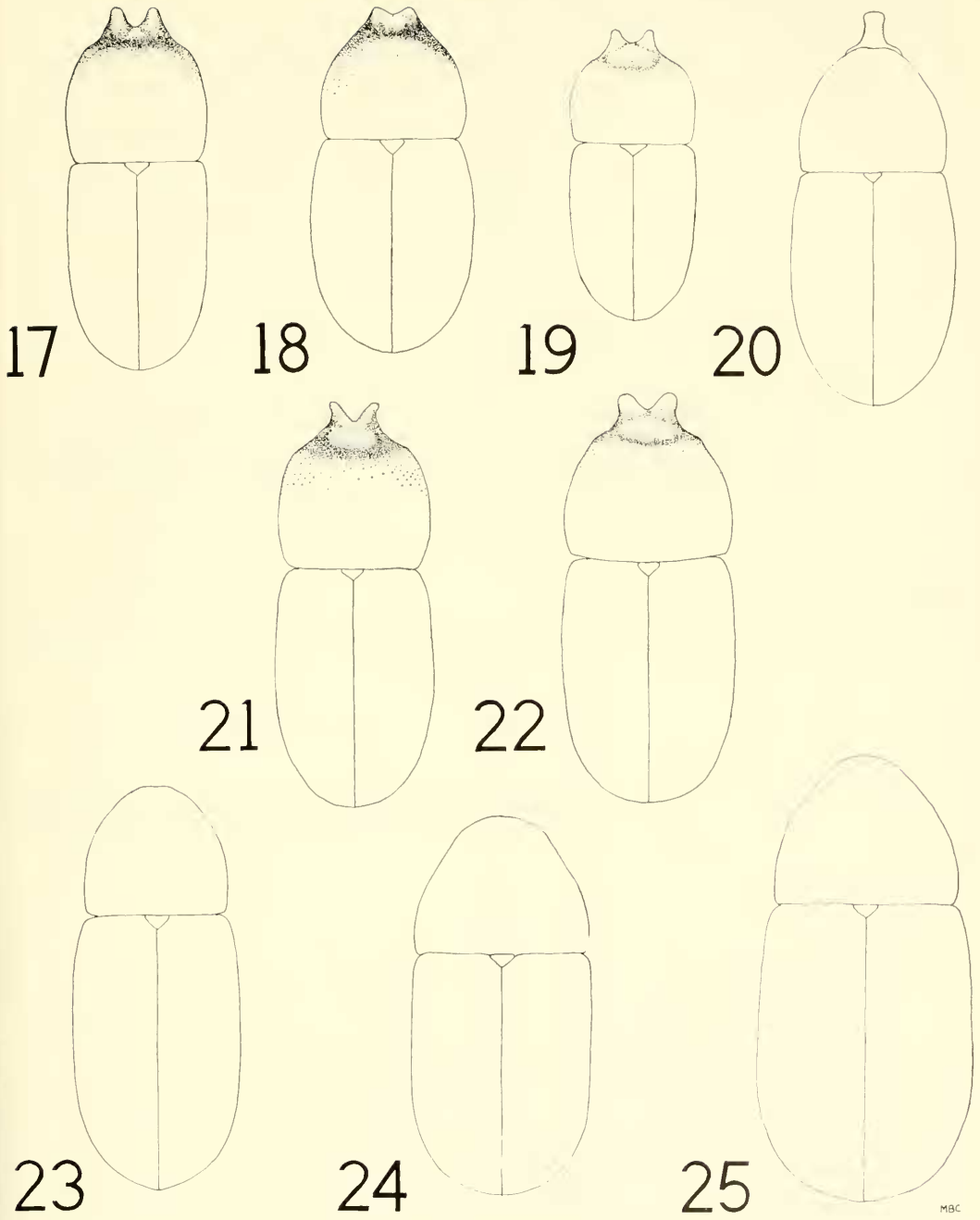
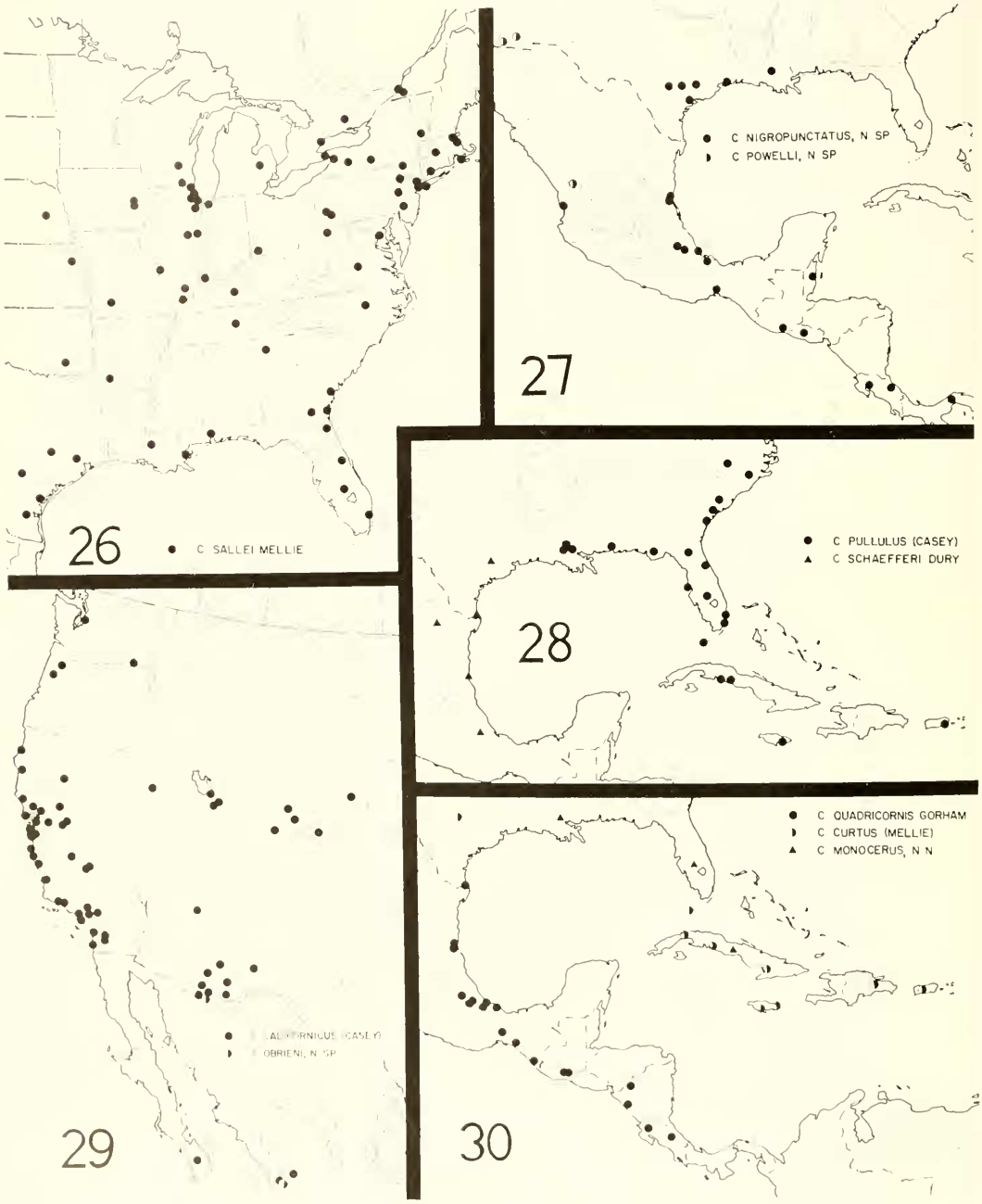
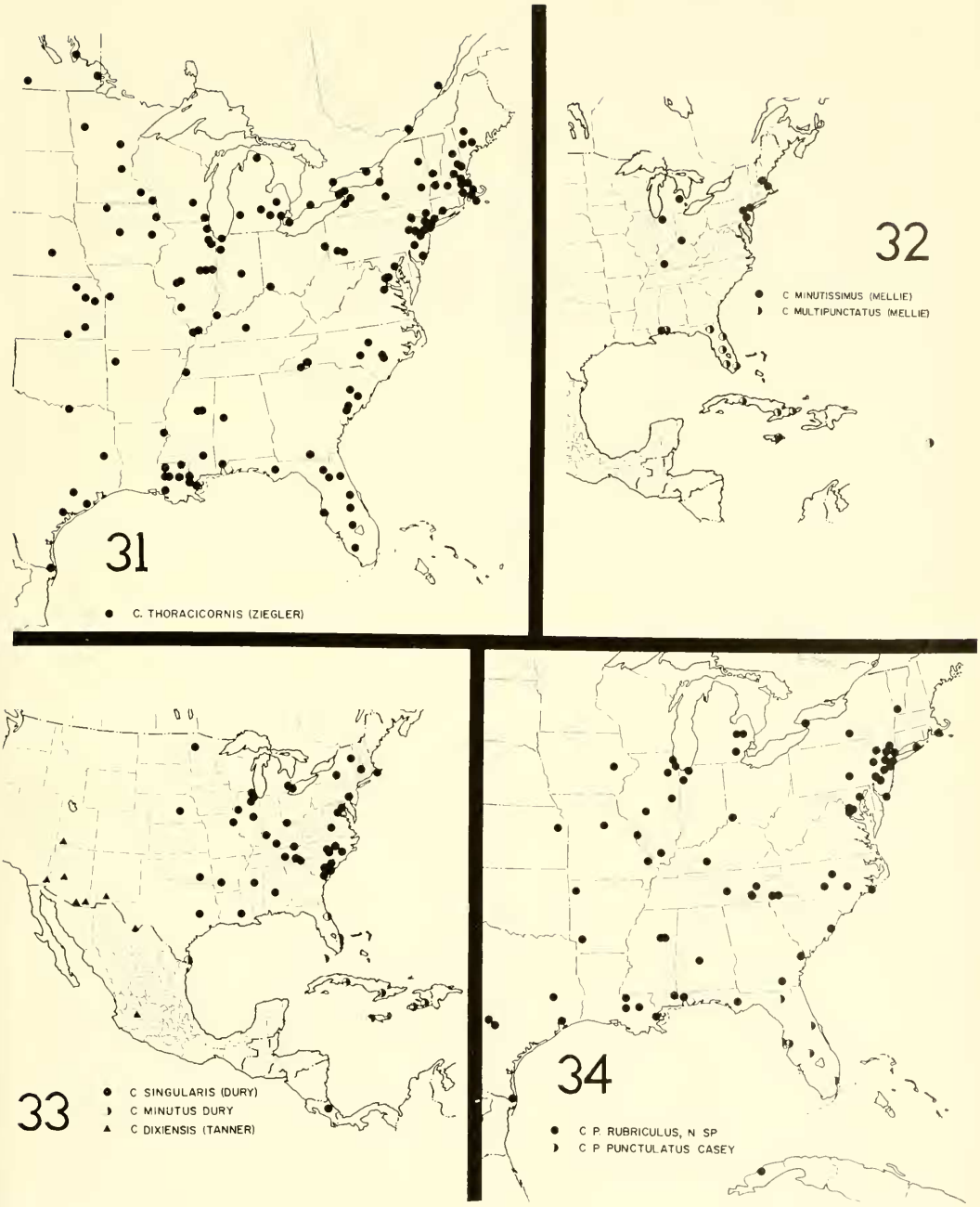
Figures 11–16. *Ceracis* spp., male, dorsal view. Fig. 11. *C. sallei* Mellie. Fig. 12. *C. singularis* (Dury). Fig. 13. *C. punctulatus rubriculus*, n. ssp. Fig. 14. *C. schaelferi* Dury. Fig. 15. *C. californicus* (Casey). Fig. 16. *C. nigropunctatus*, n. sp. All figures drawn to some scale.



Figures 17–25. *Ceracis* spp., male, dorsal view. Fig. 17. *C. quadricornis* Gorhom. Fig. 18. *C. minutissimus* (Mellié). Fig. 19. *C. minutus* Dury. Fig. 20. *C. monocerus* new name. Fig. 21. *C. thoracicornis* (Ziegler). Fig. 22. *C. pullulus* (Casey). Fig. 23. *C. powelli*, n. sp. Fig. 24. *C. multipunctatus* (Mellié). Fig. 25. *C. obrieni*, n. sp. All figures drawn to same scale.


C NIGROPUNCTATUS, N SP
C POWELLI, N SP
27
C SALLEI MELLIE
26
C PULLULUS (CASEY)
C SCHAEFFERI DURY
28
C QUADRICORNIS GORHAM
C CURTUS (MELLIE)
C MONOCERUS, N N
30
29


31
C. THORACICORNIS (ZIEGLER)
32
C MINUTISSIMUS (MELLIE)
C MULTIPUNCTATUS (MELLIE)
33
C SINGULARIS (DURY)
C MINUTUS DURY
C DIXIENSIS (TANNER)
34
C P RUBRICULUS, N SP
C P PUNCTULATUS CASEY